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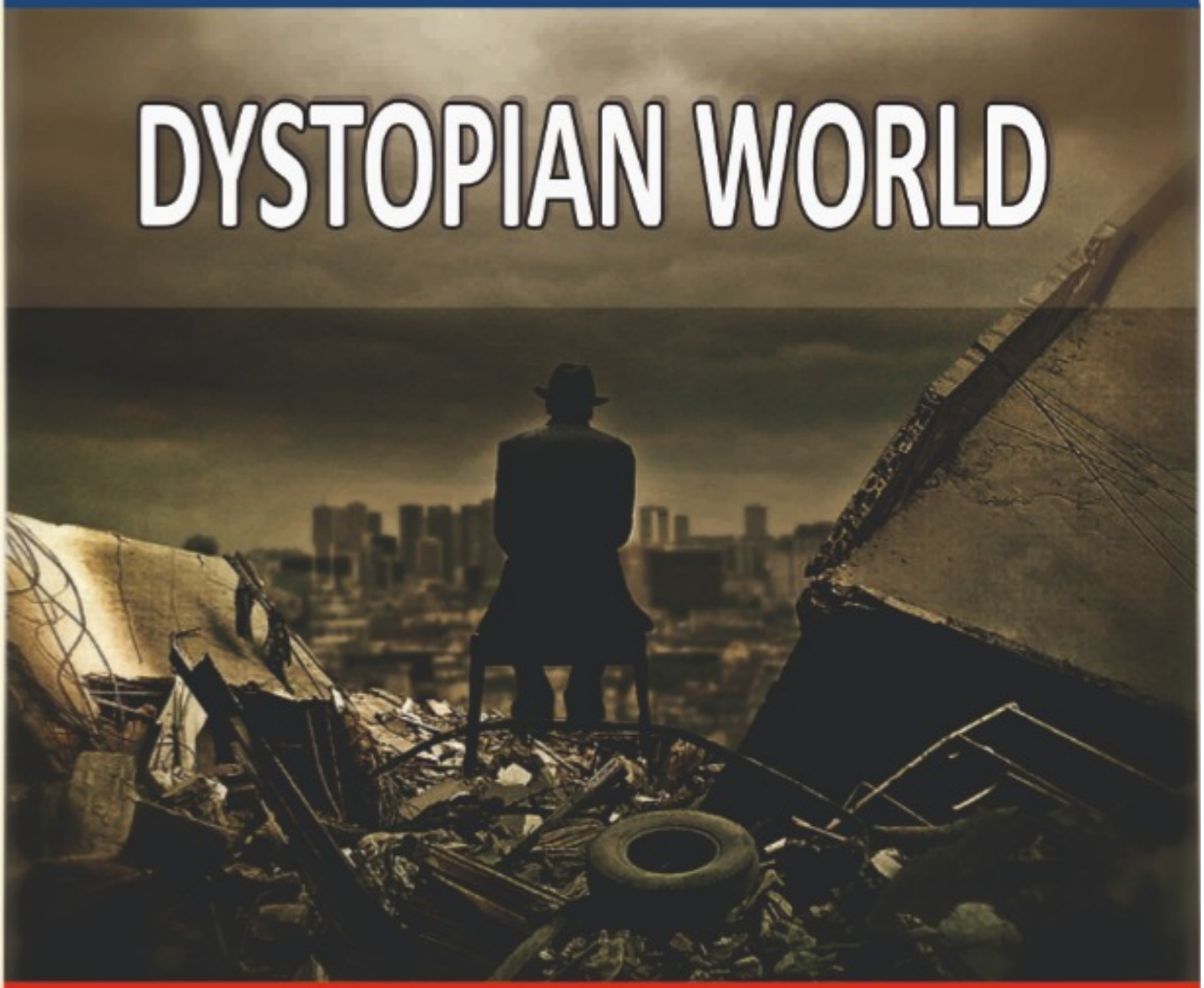
DYSTOPIAN WORLD



Monography

«Almaty Management University»

Frigerio Alberto PhD

DYSTOPIAN WORLD

Monography

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Dystopian stories are often the product of both creativity and analytics. As a result, they offer thought provoking reflections on how the world might turn into a place of desolation and misfortune if we do not recognize and intervene on the deep-rooted problems affecting our society. The main objective of this book is to raise up the public attention on a series of contemporary global challenges – such as climate change, lack of vital resources, overpopulation, global pandemics, social inequality, authoritarianism, weapons of mass destruction, artificial intelligence and genetic engineering – by provocatively claiming that the world might soon turn into a dystopia. This book is primarily intended for BA students of international relations as well as the general public.

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About the Author

Dr. Alberto Frigerio is professor of Regional Studies at Almaty Management University (AlmaU). Previously he worked as associate professor of geopolitics and international relations at Kazakh-American University. He holds a Ph.D. in Management and Development of Cultural Heritage (2013) from IMT – Institute for Advanced Studies of Lucca. He received a Bachelor Degree in International Science and European Institutions (2006) and a Master Degree in International Relations (2009) from the University of Milan. His main research areas are the international protection of cultural heritage and the critical analysis of global issues through the lens of popular culture.

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List of Abbreviations

DARPA	Defensive Advanced Research Projects Agency
FAO	Food and Agriculture Organization of the United Nations
ICRC	International Committee of the Red Cross
IPCC	Intergovernmental Panel on Climate Change
NOAA	National Centers For Environmental Information
OECD	Organization for Economic Cooperation and Development
UN DESA	United Nations Department of Economic and Social Affairs
UN	United Nations
UNAIDS	United Nations Programme on HIV/AIDS
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNECE	United Nations Economic Commission for Europe
UNICEF	United Nations Children's Fund
UNMDG	United Nations Millennium Development Goals
UNSDG	United Nations Sustainable Development Goals
UNSG	United Nations Secretary-General
UNWTO	United Nations World Tourism Organization
WBG	World Bank Group
WEF	World Economic Forum
WFP	World Food Programme
WHO	World Health Organization
WWF	World Wildlife Fund

Introduction: Dystopias & Global Challenges

'It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of Light, it was the season of Darkness, it was the spring of hope, it was the winter of despair, we had everything before us, we had nothing before us, we were all going direct to Heaven, we were all going direct the other way…'

Dickens C. (1859) *A Tale of Two Cities*

The word utopia derives from Greek and it can be literally translated as "no place" (ou-topos) or "good place" (eu-topos). Since Thomas More (1478-1535) this concept has been commonly associated with a fictional place where human society has finally constructed an ideal "way of life" – broadly interpreted as a condition of happiness, peace and social responsibility – in an idyllic spatial setting characterized, for example, by efficient political institutions, an equally distributed wealth, and a perfect balance between natural environment and technological infrastructures. Instead, the idea of dystopia refers to an extreme worst-case scenario where human hope is nullified by a state of desolation and misfortune. In other words, a dystopia is 'a non-existent society described in considerable detail and normally located in time and space that the author intended a contemporary reader to view as considerably worse than the society in which the reader lived' (Sargent 1994, 9).

The French ethnologist Jean Servier (2002, 225) maintained that utopias (as well as dystopias) are offered to us under the

veil of fiction and fantasy, but behind such veil there is another world, full of secrets and symbols. This statement seems supported by many other authors. In the introduction of the book *Dark Horizons. Science Fiction and the Dystopian Imagination*, Raffaela Baccolini and Tom Moylan (2003, 1-2) claim that 'the dystopian imagination has served as a prophetic vehicle, the canary in a cage, for writers with an ethical and political concern for warning us of terrible socio-political tendencies that could, if continued, turn out contemporary world into the iron cages portrayed in the realm of utopia's underside.' Likewise, in the book *Utopia/Dystopia Conditions of Historical Possibility*, Michael D. Gordin, Helen Tilley and Gyan Prakash (2010, 2) propose that 'whereas utopia takes us into a future and serves to indict the present, dystopia places us directly in a dark and depressing reality, conjuring up a terrifying future if we do not recognize and treat its symptoms in the here and now.'

Sincerely believing that dystopian movies might have a pedagogical utility beyond their entertaining value, this book offers an original framework of analysis, which correlates dystopian stories and contemporary global challenges. The objective is to question the readers' underlying assumptions about the security and stability of our world by disclosing how dystopian fictions might be closer to current reality than commonly expected.

The consistency of this methodological approach is based on three fundamental arguments. First of all, by critically assessing what seems unreal and implausible we can prepare our mind to explore complex issues through new lenses. In other terms, as argued by Tom Moylan (2000, xii), 'dystopian

critique can enable its writers and readers to find their way within – and sometimes against and beyond – the conditions that mask the very causes of the harsh realities in which they live.'

Second, in an époque of rapid and drastic transformations, where the world as we know might suddenly change before our eyes, assessing and promptly intervening on contemporary challenges is a vital prerequisite for building a welcoming future. As a result, revealing how, in many respects, the world is moving towards people's worst nightmares might be a simple but efficient way for raising public interest on current major challenges. As stated by Ed Finn and G. Pascal Zachary (2014, vi), 'The future is full of uncertainty and risk, but it takes a good story to push us from apathy to action.'

Finally, the future visions and catastrophic dynamics proposed in many dystopian movies are often based on more reliable grounds than people commonly think. As Dennis Livingston states (1971, 255): 'The process of developing science fiction plots often implicitly uses the same methods as nonfiction futurology – the extrapolation of current trends, the systemic survey of expert position, and the comparative analysis of the present with the analogous past. To these techniques science fiction authors add creative imagination, an unquantifiable ingredient which makes the possible outcomes of current disparate trends coherent.'

Therefore, comparing fictional and real threats seems a legitimate and reasonable approach of study as far as three conditions are respected. First, the reader should be able to

clearly recognize when the text is referring to fictional stories and when it is examining the contemporary global framework. Second, the reader should understand that dystopian movies cannot provide scientific knowledge, lacking the required proven support for their claims, but they can offer though-provoking reflections by opening up new possibility on enquire. Third, the reader should be aware that, in the assessment of potential future global scenarios a cautious approach must be kept because we are operating in an area of uncertainty where unpredictable outcomes might take place. Notwithstanding our best efforts to foresee future events, history is not a linear process: 'there are often bumps along the road, accidents along the way' (Nye 2010). Therefore, this book offers a critical assessment of the current state of affairs in order to anticipate what might be the global risks of tomorrow. It cannot (and neither pretend to) forecast the future as a magician gazing into a crystal ball.

Working on this monograph I had to make some important decisions in order to restrict the scope of this analysis. First of all, I had to decide whether to refer to dystopian novels, movies or a mix of different formats (for example, including both books and movies, but also video games, manga and television series). I almost immediately excluded the mixed option because it entailed a too dispersive research and fragmented analysis. Thus, focusing on a single format seemed to me the most preferable option.

Still, the dilemma was to choose between novels or movies. I finally decided to exclusively focus my attention on movies considering a technical and a practical factor. Technically, movies are visual story-telling tools structured on an

articulated set of images, words and sounds. As such, they offer to the audience an immediate engagement with their fictional universe. In other terms, 'because movies show (in ways that other art forms, like novels, cannot), they have an epistemic directness-they present their fictional truths immediately.' (Fiorelli 2016, iii). In the attempt to reveal a link between the examined dystopian scenarios and current reality, this seemed to me a good point in favour of movies. Practically, I realized that many dystopian movies are based or inspired by stories taken from books. Therefore, I could cover most of the contemporary dystopian narratives through the analysis of the related film adaptation.

A second issue was to define more precisely which kind of movies I had to include in my analysis. In this case, I opted for a quite comprehensive and flexible definition of dystopian movies, considering that often a blurred line separates this genre from disaster, post-apocalyptic and science-fiction movies. Overall, traditional dystopian movies tend to describe a forthcoming worst-case scenario, disaster movies commonly focus the attention on the destructive force of natural or human-made hazards, post-apocalyptic movies primarily show the detrimental conditions of life following a catastrophic event, while science-fiction movies are set in a future context that can be either better, worst or simply different in comparison to current reality.

In a few cases, I also referred to movies that are commonly viewed to belong to other categories (like, for example, horrors, thrillers and dramas) when their stories offered particularly interesting details on a specific dystopian feature. I extended similar considerations to animated movies, while I

decided to completely exclude short movies, TV movies and TV series from the scope of this study.

There was, however, an additional factor I had to bear in mind: utopia and dystopia are both social constructions that may evolve in the course of time. As sarcastically highlighted by Gregory Claeys and Lyman Tower Sargent (1999, 1), 'most sixteenth-century eutopias horrify today's reader even though the authors' intentions are clear. On the other hand, a sixteenth-century reader would consider most twentieth-century eutopias as dys-topias worthy of being burnt as works of the devil.' Therefore, I decided to focus the attention on movies released in the last 35 years. These stories are, conceivably, the best ones to reveal contemporary social anxieties and fears. Moreover, as further advantage, these films should be familiar to the whole readers.

Overall, these choices allowed me to reduce the size of this book to an acceptable length, while preserving the possibility to study a relatively comprehensive list of dystopian stories. In the end, around 100 movies are mentioned in the book. Most of them are American movies and the reason is straightforward: Hollywood movies are well-known worldwide thanks to their global distribution. Still, the book makes also references to a few European films (e.g. UK, Spain and Germany) and other international productions (e.g. Australia, Canada and South Korea).

Structurally, this book is organized in nine thematic chapters (climate change, lack of vital resources, overpopulation, global pandemics, social inequality, authoritarianism, weapons of mass destruction, artificial intelligence, and genetic

engineering) and a final conclusion. Each chapter is divided in three sections: the first one critically investigates the core features of the alternative scenarios depicted by dystopian movies; the second section examines scientific data and academic interpretations in order to assess the real extent of the considered risks and their link with contemporary global challenges; the third one schematically sums up the main issues raised in the whole chapter and offers some final critical reflections.

Chapter 1 – Climate Changes. According to several dystopian movies, climate change might dramatically transform the Earth. Three scenarios are commonly considered: a drastic growth of atmospheric temperature that might turn the world into an extensive wasteland; a future world fully covered by water due to sea level rising; and the rise of a new ice-age. Chapter 1 evaluates how concrete is the risk that one of these threatening landscapes might get real. By presenting multiple data collected by different scientific institutes of research, the chapter identifies the main related threats for the natural environment and the human society. The chapter concludes with some brief reflections on the 2015 Paris agreement and the negative impact of climate change denial.

Chapter 2 – Lack of Vital Resources. A common feature of different dystopian movies is to set their plots into a future world characterized by the scarcity of food and water. In these films, the lack of these resources seems to inevitably spark violent conflicts. In many cases rulers adopt drastic policies for facing the resulting emergency. Chapter 2 aims to understand how much hunger and thirst are effective problems of contemporary and future world. The chapter begins by

providing some general data on the issue of food and water scarcity and then it proceeds with a more critical analysis. At first, the chapter identifies the triggering causes of food and water shortage. Then, it examines the eventual blast of violent conflicts due to water conflict and food insecurity. Finally, the last part of the chapter focuses the attention on the controversial adoption of extreme policies to face the problem of hunger.

Chapter 3 – Overpopulation. Dystopian movies have widely examined the demographic issue. On one side, they prospect an upcoming overpopulated world where, in response to the unsustainable impact on Earth's resources, world governments will enforce drastic measures aimed to restrict the freedom to breed or to increase the mortality rate. On the other, they forecast an alternative future scenario where a growing infertility rate will put at risk the survival of mankind. Chapter 3 aims to understand if the world is doomed to overpopulation and/or extinction. The chapter addresses the problem of overpopulation by presenting different statistics of the world population growth and introducing the readers to the endless debate over the Earth's carrying-capacity limits and the solutions proposed for facing such complex challenge. The chapter briefly concludes with few notes on the reasons why infertility is a concrete problem, but not to the extent showed by dystopian movies.

Chapter 4 – Global Pandemics. Numerous dystopian movies narrate the blast of various pandemics that drastically endanger human survival. Chapter 4 aims to assess the impact of transmittable diseases on contemporary society and the risk that a new disease might provoke devastating results as

the Great Plague and the Spanish flu did in the past. After an initial evaluation of the death rate of diseases such as HIV/AIDS, Tuberculosis, Malaria, Ebola, flu A(H1N1) and SARS, the chapter examines the difficulties to counter the spread of infectious diseases in contemporary globalized society and it critically assess the risks associated with the outbreak of a new devastating pandemic. The chapter concludes with some brief considerations on the perils related to the intentional modification of dangerous viruses in labs for scientific purposes.

Chapter 5 – Social Inequality. Contemporary dystopian movies are characterized by a highly hierarchical society, where few people live in luxurious conditions, while the others struggle to survive in a violent environment. Chapter 5 aims to consider how much socio-economic inequality remains an unsolved problem of humanity. The chapter provides a comprehensive set of data about the growing gap between wealthy and poor persons. Moreover, it reveals how different opportunities are precluded to people living in a condition of extreme poverty. Life expectancy and crime victimization are further parameters used in this chapter for assessing the current level of inequality in the world. The chapter concludes with some considerations on the actions required to face the problem of social inequality.

Chapter 6 – Authoritarianism. Dystopian movies forecast the advent and spread of oppressive authoritarian governments in the upcoming future. Chapter 6 tries to figure out if the contemporary democratic crisis should be view as a temporary fluctuation or a rooted transformation of world politics. Therefore, in the first part, the chapter discusses the return of

authoritarian governments and the rise of hybrid regimes as evidences of a democratic crisis. Different data and arguments are considered in order to understand if this change should be viewed as a temporary flow or a long-term transformation. In the second part, the chapter critically examines the key instruments of psychological manipulation and physical repression used by the new authoritarian governments to keep their power and compares them with those used in fiction.

Chapter 7 – Weapons of Mass Destruction. Many dystopian movies describe the catastrophic effects of nuclear, biological and chemical weapons. In such stories, multiple factors (e.g. interstate war, terrorist attack or technical mistakes) might cause an apocalyptic event. The objective of chapter 7 is to analyse the effective risk that nuclear, biological and chemical weapons might be extensively used in the future. In the first part, the chapter refers to past events in order to assess the concrete risk that nuclear weapons might be effectively used one day by states or terrorists. In the second part, the chapter examines the problem of biological and chemical weapons by explaining how they have been used in both past and recent events.

Chapter 8 – Artificial Intelligence. Killer robots, AI programmes that (intentionally or by mistake) provoke nuclear disasters and dictatorial regimes ruled by AI technologies are recurring themes in dystopian movies. Chapter 8 aims to understand if these are pure fictional representations or these stories might actually anticipate some serious threats of the future. The first part of the chapter focuses the attention on the ethical, legal and political debates over the development of fully-autonomous weapons. The second part evaluates the state of

AI technology today and the risk that, in the future, human beings might be unable to keep under control this technology.

Chapter 9 – Genetic Engineering. Dystopian movies offer a highly pessimistic view about the genetic manipulation of animals and humans. Chapter 9 puts in relation the critical reflections raised by these movies with the current state of research on genetic engineering. Among the most controversial issues examined in this section there are the creation of animal-human hybrid organisms, the revival of extinct species, the genetic manipulation of animals and humans for military aims, and the application of germline gene therapies for therapeutic and enhancement purposes.

Three last short notes. This book offers a more articulated view of the ideas that were briefly introduced in an article I published in *E-IR* as well as it extends the analysis to new themes (Frigerio 2017). Second, in some cases the same movie is examined in multiple chapters for different intents. The reason is quite simple: there is a certain level of interdependence among most of the global challenges studied in this book. For example, climate change, social inequality and overpopulation are all factors that may affect the availability of food and water resources. While some dystopian movies focus the attention on a single theme, others embrace a more holistic perspective aimed to introduce critical reflections on a multiple set of issues. Third, this book provides precise and detailed information of the examined movie plots. Therefore, the risk of spoiling a film is concrete. The reader is warned.

Chapter 1: Climate Change

Fiction

In simple terms, the notion of climate change refers to a significant shift in weather conditions associated with a variation of the average global temperature. In recent years, several dystopian movies presented climate change as a serious and imminent threat. Three main future alarming scenarios are depicted by these movies: a drastic increase in atmospheric temperature that will turn the world into a limitless desert, a massive sea-level rising that will cause an extensive inundation of the mainland, and an extreme collapse of the global temperature that will provoke an endless winter scenario.

The wasteland scenario

Different dystopian movies share the view that the world's temperature might rise so much to turn the Earth into a barely liveable or, in some cases, a completely inhabitable wasteland. A similar forecast is not something new in fictional stories. However, the interesting point is that this idea has been proposed with a certain regularity in the last 10 years.

For example, the computer-animated movie *WALL-E* (2008) describes a future Earth entirely covered by waste and apparently unsuitable for any form of life. As a result of such unwelcoming conditions, people will decide to leave the planet and live in the space, on board of a gigantic spacecraft equipped with all technological comfort. Only the casual discovery of a growing small green-plant – symbol of the power of life – by a garbage disposal robot (WALL-E) will

convince the captain of the spaceship and its passenger to tentatively fly back home. From a mis-en-scène perspective, the ecological theme at the core of this movie is underlined by the introductory scene, which offers a glimpse of a desolate landscape with rubbish and debris everywhere. In contrast, the final scene reveals the enthusiasm of people in front of the possibility to re-introduce farming on Earth as well as the image of what seems a landfill fully covered by growing plants.

Several recent movies have also identified in massive solar radiations the leading cause of a dangerous global warming. In the film *4:44 Last Day on Earth* (2011) massive solar radiations increase the Earth temperature so much to cause the complete extinction of any form of life on the planet. Actually, this movie does not really offer a visual representation of what is going to happen to the Earth's environment, but rather it focuses the attention on people's emotional reactions before the catastrophe. In a thought-provoking scene an anchor-man stresses how this event is going to equally affect all people of the planet, regardless of where they live or what is their social status. Still, even few hours before the catastrophe there are some people questioning the scientific truth – that the life on Earth is going to end – revealed by scientists.

The film *Automata* (2014) narrates how a peak of solar flares in 2044 decimates the world's population and causes an extended desertification. In such a context, cities remain the last safe-heavens for the few survivals. Similarly, in *Maze Runner: The Scorch Trials* (2015) sun flares turn a vast area of the world into a huge sandy desert commonly called "The Scorch". In these two cases, the extension of the disaster is

primarily expressed by images: both movies represent the last liveable spaces as scattered small dots in an endless desert. A similar picture is also proposed by the movies *Judge Dredd* (1995) and its more recent edition *Dredd* (2012), which depict a future world where crowded mega-cities are surrounded by a contaminated desert called "Cursed Earth". In this case, however, the cause of the disaster is the blast of a nuclear conflict. Interestingly, in all these movies the idea of the city gains an ambivalent symbolism. On one side, the city is symbolically depicted as the safe-haven from the surrounding dangerous environment. On the other side, it is also a space of violence, chaos and lies. Arguably, this curious representation might be read as warn that the real threat is not centred on the hostile nature, but rather on human behaviour.

Still, *Mad Max: Fury Road* (2015) is probably the movie with the strongest visual impact. This story is set in a forthcoming desert landscape where the main characters have to face marauders, water scarcity and sandstorms to survive. The movie does not precise which factors led to such environmental disaster, but the monotonic sandy colour dominating the whole landscape catapults the audience in the middle of an inhospitable desert. Interestingly, the protagonists' search for the "Green Place" (a former lush and grassy land) turns out to be a complete failure. As a result, after a long wandering, the trip finishes in the same place where the main story begun. Symbolically, this cyclical process seems to warn about the impossibility to leave behind the climate change issue and the need to adapt to the new tragic reality.

Regardless an emphasis on diverse elements, these movies share three core ideas: first, in the upcoming future humanity will suffer the effects of a drastic increase of planet's temperature; second, the resulting global warming will transform the Earth's landscape into an endless wasteland; third, these joint conditions will cause an extensive destruction of biodiversity and they will severely challenge the human capacity to survive in a hostile environment.

The underwater scenario

Some sporadic movies have forecast an alternative scenario where most of the Earth's mainland will get covered by oceanic waters. *Waterworld* (1995) is the main cinematic reference for this type of scenario. As the title of this movie suggests, in an indeterminate future global warming will provoke the complete melting of the polar ice caps. The resulting increase of sea level will almost entirely submerge the Earth's mainland (the final scene reveals that part of the Mount Everest is a liveable space uncovered by oceanic waters), thus forcing humans to live on ships or on artificial atolls. The blue colours of sea and sky dominate during the whole duration of the movie, while the green lemon tree possessed by the protagonist is the visual emblem of what have been lost. One of the most intriguing point of the movie is the dualism between adaptation and migration toward a safe place. On one side, the movie reveals that adapting to the new environmental circumstances might be possible (at least temporarily). Still, on the other side, the protagonists adventure themselves in a long and risky journey with the purpose to find dry land, here symbolically represented as the only available place for a prosperous future.

Slightly different is the movie *2012* (2009). In this story the neutrinos released by violent geomagnetic storms are the cause of multiple extreme cataclysms, included earthquakes, volcanic eruptions and a final gigantic tsunami that temporarily submerges most of Earth's land surface. Beyond the spectacular special effects used to show the catastrophe, this movie raises some provocative reflections on the social impact of environmental disasters. While famous and rich people can get a sit in the high-tech arks created in secret to ensure the survival of humanity, the rest of people are just abandoned to face their shocking destiny.

So, beyond the common idea of an almost-completely submerged world, what these movies seem to share is the perception that looking for a "safe-haven" – here interpreted as a piece of dry land – will be the key to survive. However, only few restricted groups will have the chance to look for salvation.

The frozen scenario

Differently from such forecasts, a number of contemporary dystopian movies foresee the coming of a new Ice Age. In the movie *The Day After Tomorrow* (2004), the melting of polar ice provokes a disruption of the North Atlantic Ocean current. As a result, a series of violent storms begins to hit the northern hemisphere causing a drastic drop of the atmospheric temperature. The climax is reached when the temperature reaches quota minus 100°C, thus completely freezing the city of New York. Beside the drastic weather changes shown in the movie, a reiterated topic is the need to preventively act before it might be too late. This idea is particularly emphasized in two moments. First, at the beginning of the movie, when the

protagonist – an American paleo climatologist – raises the issue of an impending climate shift during a conference of the United Nations in New Delhi. However, his theory is neglected by US vice-President who considers it unreasonably catastrophic and in contrast with the economic interests of the country. Then, at the end of the movie, when the same person – now acting as US President – addresses the nation apologizing for his erroneous underestimation of the consequences of environmental exploitation and thanking the Third world for accepting them as refugees.

The risk of a frozen world is also explored by the movie *The Road* (2009). This film is set in a near future where a catastrophic event turned the world into a dark and frosty landscape. Unfortunately, there are not enough details to conclusively state the origin of the disaster and the author of the story has never revealed it. Speculatively, the fans of the story commonly make reference to a cosmic impact, a super-volcanic eruption or a nuclear war (Science Fiction & Fantasy Stack Exchange 2011). Anyway, what the movie clearly reveals is that a similar circumstance would provoke devastating consequences for the whole living species, with humans, animals and plants facing the threat of extinction. Indeed, the story narrates how the few survivors are forced to constantly face cold and hunger in order to last in this highly hostile environment.

Recently, some dystopian movies have also started to conceive the possible rise of a new Ice Age as a result of the unsuccessful ambition to control the planet's climate through new technologies. For example, in the Korean movie *Snowpiercer* (2013), a failed engineering attempt to stop

global warming unintentionally provokes a drastic collapse of global temperature, thus killing most of the people on Earth. The sole survivors are the refugees on the "Snowpiercer", a train that travels around the globe by means of a perpetual-motion engine. The Canadian film *The Colony* (2013) is based on similar premises. In 2045 humans build special machines that can cool the atmospheric temperature, thus reducing the impact of global warming. However, a malfunctioning causes a wave of frost that forces survivors to live in underground bunkers. In one scene of the movie *Geostorm* (2017), a UN contingent discover a completely frozen village in the desert of Afghanistan. The cause of the disaster is a sabotage of the net of satellites, equipped with geo-engineering technologies, that (ironically) humans built to control climate change and mitigate natural disasters. So, all these movies seem to share the same doubts over the possibility that advanced technology might, one day, reliably and efficaciously solve the problem of global warming without producing unexpected perils.

Whether caused by natural phenomenon or human mistakes, a frozen world will completely transform the Earth's landscape, and provoke massive casualties. The few survivors will be forced to search for a more friendly environment or adapt – with great difficulty – to the new harsh reality.

Reality

As we have seen, there are three main dystopian scenarios associated with the climate change theme: first, as effect of growing temperatures trees and plants will disappear leaving space to a barely liveable desert landscape; second, a remarkable increase of sea levels due to the melting of polar

caps or the formation of a gigantic tsunami might result in a total or partial inundation of dry lands; third, for natural causes or human irreversible mistakes the Earth could face the risk of a new Ice Age that will drastically challenge humans' capacities to survive. Therefore, quoting Bill McGuire's book *Global Catastrophes. A Very Short Introduction* (2002, 45), the core question is: 'How do we wish our familiar, contemporary world to end – by fire or by ice?'. The following section examines to which extent these three scenarios should be viewed as plausible outcomes.

The wasteland scenario

'Let us not take this planet for granted' (Di Caprio 2016). These are the words chosen by Leonardo Di Caprio to conclude his speech at the 2016 Academy Awards. His goal was to sensitize the public opinion about the problem of climate change and to call for urgent interventions for preventing what might be an imminent disaster. Unfortunately, several data seem to suggest that the problem might have already reached catastrophic proportions.

The international scientific community broadly accepts the idea that the Earth temperature is rapidly increasing. The Intergovernmental Panel on Climate Change (IPCC) (2015, 2) specifically recognizes that 'warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia.'

Likewise, there is a widespread scientific consensus over the impact of human activities on the global warming process. Actually, multiple natural and human factors may contribute to the rise of global temperatures (Burroughs 2007, 151-210).

Nevertheless, a central aspect of the problem is the extensive release in the atmosphere of greenhouse gases produced by human activities like, for example, farming, industrial manufacturing and transportation. Naturally, these gases have a blanketing effect: acting as a barrier, they absorb some of the radiation emitted by the Earth's surface, thus reducing the release of radiation out to space. An increased amount of carbon dioxide in the atmosphere would, therefore, have the effect to warm up the surface and lower atmosphere by re-directing an amplified amount of longwave energy back to Earth. The problem is that, in 2016, the globally average concentration of carbon dioxide in the atmosphere has reached a new record: 403.3 parts per million, which means 'the highest level in 800,000 years.' (World Meteorological Organization, 2017).

This growing concentration of greenhouse gases in the atmosphere is actively contributing to the registered increase of global temperatures. The concept of anomaly refers to the difference between the 20th century average temperature of the world and the registered temperature of a specific year. Since the 1980s global land and ocean temperature anomalies have significantly grown (NOAA 2017) and the last three years have been the warmest years in the global records (NOAA 2018).

Overall, in the last century, global temperatures increased by about 0.6-0.8°C and John Houghton (2009, 13) estimates that, without the enforcement of efficient strategies aimed to cut the emission of carbon dioxide, the global average temperature might rise by three or more degrees in a century. At first glance, it might seem an almost imperceptible

variation. However, living ecosystems are founded on the fragile balancing of several interconnected factors. Therefore, a difference of few degrees in the global average temperature is enough to provoke catastrophic consequences on the whole natural environment and, in turn, on contemporary human society.

Extensive desertification and land degradation have been registered in different regions of the world. The Secretariat of the United Nations Convention to Combat Desertification (2014, 4) reports that, as combined effect of climate change and unsustainable human activities (like, for example, intensive farming, mining and overgrazing) '12 million hectares of productive land become barren every year due to desertification and drought alone.' The World Atlas of Desertification and the IPBES report on land degradation provide further astonishing data: nowadays, 40% of Earth's land is already occupied by drylands – 'climatic zones where the ratio of long-term mean annual precipitation to potential evapotranspiration is less than 0.65' – and approximately 75% by degraded land – 'land that has lost some degree of its natural productivity due to human-cause processes' (European Commission Joint Research Centre 2018, 15; IPBES 2018, 10; World Resources Institute n.d.).

The situation could get even worst in the next future. According to a recent study, if the Earth's average yearly temperature should reach to 2°C above the pre-industrial era, 20%-30% of world's land surface might suffer aridification by 2050 (Park et al. 2018). In other terms, this means that, in the next future, over one quarter of the planet's land might look like the wasteland scenarios of *Automata* (2014), *Maze*

Runner: The Scorch Trials (2015) or *Mad Max: Fury Road* (2015).

The expected struggle for environmental security is likely to cause turmoil in many countries, thus leading to an extensive migration towards more advantageous states. Some researchers estimated that, by 2050, hundred million people will be forced to abandon the place where they live due to environmental degradation (Myers 2002; Biermann and Boas 2010). Although these numbers have been widely contested due to the difficulties to collect accurate statistical data in relation to a highly unpredictable phenomenon like environmental migration, the problem is consistent (Gemenne 2011, 45).

For instance, desertification is already transforming certain vulnerable areas of the world into inhospitable places. Sub-Saharan Africa is one of the regions mostly affected by this process: 'in West Africa, a creeping desertification is in progress, with 1,350 square miles of Nigerian land turning into desert each year, uprooting farmers and herdsmen and causing internal migration towards coastal areas' (Global Humanitarian Forum 2009, 49). The complexity to adapt to the rising aridity will force a significant part of the rural population living in Sub-Saharan Africa to move to urban centres.
As in *Automata* (2014), *Dredd* (2012) and *Maze Runner: The Scorch Trials* (2015), cities will be viewed by many as safe-havens against the rising environmental threats as well as lands of better opportunities. However, the combined effects of urbanization and climate change will plausibly augment the environmental, economic and social pressures over the urban areas. As a result, cities will have to 'develop a resilient

infrastructure in order to reduce their vulnerability to the many risks associated with climate change' (European Commission Joint Research Centre 2018, 83). If this will not happen, many urban centres might get incapable to meet the rising demand of energy, security and accommodations.

Besides human beings, all other living species are also at risk due to global warming. A noteworthy increase of land temperatures would have detrimental consequences on all those plants and animals that are incapable to adapt to the new environmental conditions. Actually, global warming has already started affecting biodiversity, for example, by changing life cycles, species distribution and population sizes (IPCC 2002). Likewise, the rapidly growing oceanic acidification – since the Industrial revolution the acidity of surface ocean waters has increased of nearly 30% and 'by the end of this century the surface waters of the ocean could be nearly 150 percent more acidic' (NOAA – Pacific Marine Environmental Laboratory, n.d.) – is a direct cause of the observed extensive destruction of the coral reefs in the world. This degrading process is, in turn, causing severe damages on the whole marine ecosystems (Hoegh-Guldberg et al. 2007).

As reported by Tyler Miller and Scott Spoolman (2012, 192), 'during this century, the extinction rate caused by habitat loss, climate change due mostly atmospheric warming, and other environmentally harmful effects related to human activities will rise to 10,000 times the background rate. If this estimate is correct… this would amount to an extinction rate of 10,000 species per year for every 1 million wild species living on the earth.' If important measures will not be promptly taken, the extinction of mammal species in the next 50 years might be so

extensive that the world will need millions of years to naturally recover from such biodiversity catastrophe (Davis, Faurby and Svenning 2018). As a result, the line separating fiction and reality blurs to a point of alarm when imagining a world without animals.

The underwater scenario

The image of an almost-completely submerged world offered by *Waterworld* (1995) and *2012* (2009) is quite unrealistic from a scientific perspective. As reported by National Geographic (2013) even in the undesirable circumstance that all the ice on Earth should melt – condition that would require at least 5,000 years – the sea level would rise about 216 feet (approximately 66 meters). In such eventuality, the increased sea level would significantly reduce the world's land area, but far from covering its complete surface. Unfortunately, scientific research also reveals that the sea level is steadily rising and it might put at risk the life of millions of people living in numerous islands and coastal areas around the world.

Contemporary sea level change is primarily related to two phenomena: the thermal expansion of oceanic waters and the melting of mountain glaciers and ice sheets (Greenland and Antarctica) (Church et al. 2013). Scientific data show that from January 1870 to December 2004 the world registered a see level rise of 195 mm (Church and White 2006). However, in response of global warming, the rate of sea level change is expected to increase in the next future. According to a recent study, the prospect is that, by 2100, the see-level might plausibly rise by around 65 cm (Nerem et al. 2018). However, in a worst-case scenario, sea-level might rise up to 2 m by 2100 (Bamber et al. 2019).

The number of people who live in areas at high risk range from around 153 million up to 627 million in case of a 4°C warming scenario (Kopp et al. 2017; Strauss, Kulp and Levermann 2015). As the protagonists of the movies mentioned above, a large number of people (plausibly, in the order of millions of people) might inevitably be forced to leave their lands by the end of this century. Therefore, as suggested by Nerem (2015, 121), 'sea level rise is likely to be a serious socioeconomic problem in the future.'

The impact of sea level rising will not be equally distributed at global level. Although cases of forced displacement would likely occur in the whole world, Asian countries like China, Vietnam, Japan, India and Bangladesh are those with the highest amount of total population exposed to the risk of increasing flooding (Strauss, Kulp and Levermann 2015). For some developing countries the economic and ecological impact might be catastrophic (Dasgupta 2007, 44).

Anyway, sea level rising is not a mere long-term problem: some coastal zones in various parts of the world are already suffering systematic floods and certain Pacific island-states (like, for example, Kiribati and Tuvalu) are progressively getting submerged by oceanic waters (Doherty 2017). In Kiribati, recurrent storms and flooding are destroying local crop production, damaging buildings and reducing the availability of fresh water. To face the impending catastrophe, the Kiribati government is taking diverse measures aimed to prevent coastal erosion and reduce the risk of inundation. However, such measures can only temporarily mitigate the problem. As backup plan, the government is ready to

progressively relocate the islanders of Kiribati to 6000 acres of land which have been purchased from Fiji in 2014. Former-president of Kiribati, Anote Tone, referred to such plan as a "migration-with-dignity" strategy (UNGA 2014).

On the whole, this eco-disaster raises numerous legal and political questions concerning, for instance, the rights of states that might disappear due to such calamity, the treatment of the resulting environmental migrants and the issue of responsibility for such announced tragedy (McAdam 2010). Nevertheless, it seems that the international community is underestimating the problem notwithstanding the overwhelming evidence collected by numerous scientific studies.

In addition, as in the movie *2012* (2009), the risk is that while the rich will be somehow able to face the emergency, the poorest will be doomed by the impending catastrophe. As provocatively asked by an article published in *The Guardian*, 'the rich can afford to move – what about the poor?' (Milman 2018) Any strategic plan aimed to face such a situation of emergency would need to keep into account social inequality among its parameters of analysis, otherwise salvation would hazardously become an exclusive option for a restricted group of people.

A final note. Even if land abandonment is often viewed as an inevitable outcome, at least theoretically, other options could be more technically feasible and economically advantageous than moving an entire population. For instance, cannot adaptive measures be taken to face the adverse conditions linked to sea level rising? In its fictional and highly unrealistic

setting, the film *Waterworld* (1995) suggests that, despite obvious difficulties, human civilization can continue even in an underwater scenario. Some studies reveal that implementing special measures of coastal protection might, actually, provide beneficial results. For example, the construction of dikes and the adoption of beach nourishment measures might drastically reduce the number of displaced people (Nicholls et al. 2011). The problem is that this strategy requires substantial economic investments to be enforced. Indeed, the central problem rests unsolved: while developed countries would be potentially able to afford the development of adaptation plans, the limited financial resources of developing countries would constrain their capacity to follow similar paths. So, adaptation might be a concrete solution in some cases… but it is unlikely that it will be available for all.

The frozen scenario

As we have already seen, some dystopian movies forecast that climate change will bring about a great reduction in temperatures, thus shaping a future frozen world scenario. However, it is highly implausible that a similar circumstance will occur any time soon.

A recent study reveals that the Atlantic Meridional Overturning Circulation (AMOC) – a large system of currents in the North Atlantic which plays an important role in Earth's climate – has slowed down by around 15% since the middle of the 20th century (Caesar et al. 2018). Nevertheless, the idea that climate change might cause a complete collapse of the Atlantic thermohaline circulation, as shown in *The Day After Tomorrow* (2004), is unlikely (ClimateSight 2012). Even in the implausible circumstance that such event should effectively

occur, its impact would hardly be so extreme and catastrophic as shown in the movie. For instance, on the base of a climate model developed by Sybren Drijfhout (2015), the collapse of the AMOC would provoke a global cooling for a period of 15-20 years, but then the process would be reversed and global warming would continue at present-day rates. Still, several intervening aspects remain uncertain and, therefore, it is impossible to provide some definitive statements on the matter.

Anyway, other natural factors may intervene causing a noteworthy cooling of the atmospheric temperatures. For example, the Milankovitch theory states that periodical variations of eccentricity, axial tilt and precession of the Earth's orbit can determine relevant climatic changes by decreasing the amount of solar radiations that hit the Earth's top atmosphere. As a result, our planet regularly faces low temperature cycles that might eventually lead to a new Ice Age at some time in the future. However, this condition does not seem to be a forthcoming prospect: recent studies forecast that the ongoing interglacial phase might last another 50,000 years. (Berger and Loutre 2002)

A further possibility is the idea of a volcanic or cosmic winter. In this case the reduction of global temperatures would be determined by the ash and sulfuric acid released during a super-eruption (volcanic winter) or by the dust lofted into the atmosphere due to the crash of an asteroid or comet on the Earth' surface (impact or cosmic winter) (Rampino, Self and Stothers 1988; Chapman and Morrison 1994). The mechanism is simple: the dust and gases (in particular, the sulphur dioxide) raised by these natural hazards can reach the

stratosphere where, after a series of photochemical reactions, are converted into particles that can block solar radiations for many years, thus causing a long-lasting and rigid winter on the entire planet. The collapse of global temperatures would likely reduce the amount of available resources in the world. As effect of the resulting famine, global population rate would probably face a severe decline. However, these are highly improbable events. Scientists estimate that in the last two million years the Earth likely faced two super-eruptions every 100,000 years, while the risk of impact with a one-kilometre cosmic rock is one per 600,000 years (McGuire 2002, 63 and 98).

Still, there is a remarkable difference between improbable and impossible. In 1816, the eruption of the Tombora volcano in Indonesia was so powerful that it caused a temporary reduction of global average temperatures, thus triggering the so called “Year Without a Summer”. This event is a reminder to the world that also unexpected or underestimated circumstances might take place. (Klingaman and Klingaman 2014)

In 1983, a group of scientists commonly known as the “TTAPS group” (considering the initials of their surnames) claimed that, as a reaction to a series of nuclear explosion on the main world urban centres, the smoke released in the atmosphere by the resulting fires would produce a severe drop in the temperature known as nuclear winter (Turco, Toon, Ackerman, Pollack and Sagan 1983). According to their reiterated computer simulations, ‘the cooling would probably be at least as severe as the difference between present temperatures and those at the worst of the last Ice Age’

(Sagan and Turco 1993, 369). This predicted scenario highly reminds the cold and inhospitable lands shown in the movie *The Road* (2009). However, different researchers have harshly criticized the nuclear winter theory. For example, according to Russell Seitz (2011, 37) research done in recent years have significantly constrained the existential risks of a nuclear winter: 'since 1983, the projected worst-case cooling has fallen from a Siberian deep freeze spanning 11,000 degree-days Celsius (a measure of the severity of winters) to numbers so unseasonably small as to call the very term "nuclear winter" into question.' Still, the nuclear winter debate seems far from ending (Lepore 2017; Robock and Druyan 2017).

A last note about the possibility that a frozen world might be associated with an unsuccessful attempt to control climate change through advanced technologies like in the movies *Snowpiercer* (2013), *The Colony* (2013) and *Geostorm* (2017). Climate engineering is an experimental field of research which specifically explores the development of new techniques to counter global warming by directly intervening on the Earth's climate system. Overall, the studies on climate engineering have received a lukewarm reception by environmental organizations and climate scientists. On one side, countries might further reduce the investments in climate change mitigation and adaptation strategies due to a blind faith on climate engineering (Union of Concerned Scientists USA 2017). On the other side, the fear is that potential undesirable effects might result from climate engineering: the Earth's climate system is based on a delicate equilibrium, therefore any critical intervention aimed to remove greenhouse gasses directly from the atmosphere or to reduce the Earth's absorption of incoming solar radiation is viewed as a risky

process that deserves extreme caution (Hegerl and Solomon 2009).

Although the idea of a frozen world due to climate engineering seems, at present, purely fictional, dystopian movies like *Snowpiercer* (2013), *The Colony* (2013) and *Geostorm* (2017) accurately warn about the unforeseen risks of climate engineering. In fact, one of the most crucial challenge is the extreme difficulty to predict what will exactly happen in the whole world following the use of geoengineering technologies. For example, a research reveals that injecting sulphate aerosol in the atmosphere might cool the planet and slow sea level rising, but it would also (*inter* alia) produce drought in Africa and Asia, cause ozone depletion and change the blue colour of the sky (Robock et al. 2009). Moreover, moving the discussions from capability to implementation will be a critical turning point (MacCracken 2013, 415-416). As claimed by Clive Hamilton (2013, x): climate engineering 'is not just a technological problem, nor even an ethical one as usually understood; it goes to the heart of what it means for one species to hold the future of a planet in its hands.' So, beyond the concrete feasibility to halt global warming through climate engineering, there is an even more fundamental issue at stake: even if, one day, innovate technologies would allow humans to effectively control climate, should the world accept the burden of such a thorny task?

In spite of these controversial issues, the experts attending the 2017 United Nations Climate Change Conference in Bonn expressed favourable views on proceeding the research on climate engineering as far as a proper attention will be place

on the analysis of the risks associated with these innovative techniques and the development of climate engineering will be considered as a supplement to climate change mitigation (UN 2017). There are also specialists, like Brian Launder and J. Michael T. Thompson (2010, xv), who believe that 'while such geoscale interventions may be risky, the time may well come when they are accepted as less risky than doing nothing.' So, the public debated over climate engineering and its risks seems just at the beginning.

Final remarks

As claimed by Mizan R. Khan (2016, 14), climate change 'can easily be regarded as the most complex global policy problem'. At present, the world has not yet experienced on global scale the extreme natural calamities shown in dystopian movies. Nevertheless, climate change is already transforming the natural environment and turning the life of many people into a real dystopia.

Concerning the wasteland scenario, scientific evidence suggest that global temperature is growing and land degradation is getting more intense in several regions of the world. Many species are at risk of extinction and millions of people could be forced to migrate as a direct consequence of global warming and desertification. Even if the risk of a complete underwater scenario is pure fictional, data clearly shows the sea-level is steadily rising. Millions of people living in coastal cities and low-lying islands already suffer the devastation of recurrent flooding. By the end of the century, hundred-millions people might be forced to abandon their homes unless drastic measures won't be taken to slow down sea level rising or to

adapt to the upcoming adverse conditions. The frozen world scenario is the most unlikely one. Actually, there are theories that foresee some risks of a similar outcome (Milankovitch theory; volcanic, cosmic and nuclear winter theories), but they are all related to extreme and rare events. Likewise, the idea that geoengineering might provoke deep freezing temperatures on the whole world is not really supported by scientific evidence. Nonetheless, movies like *Snowpiercer* (2013), *The Colony* (2013) and *Geostorm* (2017) must be praised for having raised thought-provoking reflections about the unforeseen risks related to this technology.

A few final considerations. With the growing awareness of the problem, the international community has progressively institutionalized climate change as a top priority issue (Hall 2016). During the last years, a series of international meetings has been regularly organized with the intent of addressing this challenge through the adoption of specific agreements. The 2015 Paris Agreement is the last major achievement in this field. The Preamble of this Agreement recognizes the need of 'an effective and progressive response to the urgent threat of climate change' (UN 2015, Preamble). The core goal of this legal document is to maintain the increase in the global average temperature well below 2°C above pre-industrial levels and making efforts to limit the temperature increase to 1.5°C (UN 2015, art. 2).

Overall, 195 countries signed the Paris Agreement and 169 states ratified it to date. However, there are some who do not acknowledge the need for immediate actions. The most notable example is the current President of the United States of America, Donald J. Trump, who has repeatedly called global

warming a “hoax” and, on 1 June 2017, he announced the U.S. withdrawal from the Paris Agreement (Zhang et al. 2017). This is a substantial step back for the success of the Agreement considering that the US is the second largest CO2 emitting country in the world. The problem, as suggested by Kirsti M. Jylhä (2016, 8), is that ‘climate change denial does not merely reflect a general unwillingness to change, but more importantly seems to include the acceptance of unequal distribution of power and risks between different groups of people.’ In other terms, some people egoistically believe that the advantageous condition they currently enjoy might anyway safeguard them from the harmful effects of climate change.

This mix of scepticism and egoism also characterized the whole background of movies like *4:44 Last Day on Earth* (2011) and *2012* (2009). But, as shown there, a free-rider approach is not a valuable strategy in relation to climate change. Although global warming will probably affect at first the most disadvantaged countries, in the long-term the whole world will suffer the detrimental effects of the resulting environmental changes. Therefore, if they want to preserve their high-quality standards of life, developed countries necessarily have to promptly join the international community in addressing this challenge. Otherwise, the risk is that ‘at some point, the impact of climate change will become too large and costly – economically, socially, environmentally – for societies to adapt’ (Richardson, Steffen and Liverman 2011, 101).

Chapter 2: Lack of Vital Resources

Fiction

The lack of vital resources, such as for example food and water, is a theme regularly featuring in dystopian stories. The main aspects commonly examined by these movies are: the causes of the disaster, the inevitably spread of conflicts over the control of these resources, and the adoption of extreme measures to face the emergency.

Food and water scarcity: causes

Dystopian movies tend to explain a dramatic lack of vital resources in both absolute and relative terms. In the first case, famine and drought are mostly the result of global catastrophic events due to human induced disasters or natural phenomenon. For example, *The Road* (2009) is set in a post-apocalyptic world – speculatively, a nuclear winter setting – with no animals or crops. The last survivors spend their days scavenging for food and clothes in the rubble. Likewise, in *Interstellar* (2014) the combined effects of recurrent sandstorms and crop blights threat to completely destroy the agricultural production. As a result, the colonisation of a new habitable planet is viewed as the last hope for humanity. Interestingly, both movies make use of an accurate selection of colours and lights which give to the viewers' an immediate feeling of sorrow over the decaying planet: in *The Road* (2009), a dull grey characterized the whole landscape, while in the initial scenes of *Interstellar* (2014) a dusty brown is used to emphasize the inhospitable nature of the place. Likewise, the core message is identical: without the chance to produce enough food, human survivability is at stake.

In the second case, the problem is not primarily a lack of resources, but rather their inequal distribution. For example, this is the case of *The Hunger Games* (2012) where the citizens of the richest and most powerful districts have access to a great variety of food and they are used to drink a special beverage which help them to puke and then start eating again. Differently, the people of the poorest districts commonly suffer food deprivation and hunger. A similar condition is shown in the film *Snowpiercer* (2013), where those living in the tail of the train have no access to the copious resources available to the passengers of the first wagons and, therefore, they can survive only by eating distasteful gelatinous-bars (being unaware of what they are made from). Therefore, these movies suggest that hunger might actually be an "unbecoming" social phenomenon.

Although in rather simplistic and vague terms, effective lack of resources, mismanagement and unfair distribution are commonly identified as the main causes of water scarcity by dystopian movies. For example, in the movie *Tank Girl* (1995) an unexpected cataclysm – the fall of a comet – is the cause of a long-lasting draught which significantly constrains the availability of water on Earth. Nevertheless, the plot of this movie emphasizes even more how the monopolization of remaining water supply by a greedy private company is, actually, the primary cause of suffering for most of the people. Differently, in the movie *Young Ones* (2014) the causes of drought are plausibly attributable to climate change, but the tacitly repeated message is that, through a more efficient system of water management, the lands may return to being productive. In other terms, although nature might be the

primary cause of water scarcity, human incapacity to successfully face such challenge is what needs to be blamed.

The conflicts for vital resources

A number of dystopian movies tend to show how, in a condition of procrastinated food and water scarcity, human society would collapse and people would clash for get control of these vital resources. For instance, *The Last Survivors* (2014) is a movie sets in a hostile future world characterized by a constant drought. Here drinkable water turns into a luxury good for which people are ready to fight and, eventually, kill. The veiled idea that extreme circumstances may reshape the basics of morality is presented by setting all the main scenes of violence in the surrounding arid landscape as if the two elements – drought and violence – are intimately and inevitably connected to each other.

Likewise, in the desert landscapes of *Turbo Kid* (2015) and *Mad Max: Fury Road* (2015) water is a resource of inestimable value. As a result, the control of water resource is used by tyrants as a condition to impose their will over their thirsty subjects. One initial scene of the movie *Mad Max: Fury Road* (2015) catches the essence of this prerogative: from the top of its stronghold the antagonist (Immortan Joe), after presenting himself as the redeemer, activates the water dispenser control. On the ground, the thirsty mass suddenly crowds around the resulting water fall which, however, lasts only few moments. Sarcastically, the scene ends with Immortan Joe who invites his desperate citizens to do not get addicted to water while they fight each other's to get some last reserve of water.

This strict correlation between available resources and human security is object of deep thoughts in the movie *The Book of Eli* (2010). In one emblematic scene, the main character reflects on how, in a context of abundance, people do not realize what is precious whereas in a condition of resource scarcity people are ready to kill for things they were throwing away. Somehow, this is what occurs in the movie *The Survivalist* (2015), where people are ready to risk their life for a hot soup or a bunch of seeds. Using an ironical expedient, this idea is also depicted in a scene of the film *This Is the End* (2013), when a group of Hollywood stars who is trying to survive the "Apocalypse Day" get into a serious dispute for deciding who should eat the last Milky Way snack. The movie *The Road* (2009) further stresses the relation between food insecurity and violence: after the catastrophe, the breakdown of civil institutions and the impossibility to cultivate any nourishment triggered the spread of violence and the rise of groups of bandits willing to do whatever necessary in order to satisfy their primary need of food.

Therefore, the main lesson of these movies is rather pessimistic and cynical: in a condition of enduring food and water scarcity, human society would inevitably turn into a Hobbesian state-of-nature characterized by a war of all against all for the control of the last available resources.

The adoption of drastic solutions to face hunger

In many instances the problem of famine is solved through the adoption of drastic solutions. The first solution is the production and consumption of artificial food. In *Matrix*

(1999), the Earth's surface is under control of dangerous AI machines. The last free-humans survive living in a colony near the Earth's core and travelling on special ships among the countless tunnels dug into the Earth's crust. In one scene, the crew of one of these ships eat an unappetizing mash based on synthetic amino acids, vitamins and minerals. In the same scene, one member of the crew claims that this is all a human body needs for its subsistence. Still, the complexity to adapt to artificial food is emphasized by the betrayal of a ship member whose desire is to be unconsciously reintegrated in the Matrix (a simulated reality created by machines to enslave human beings) in order to enjoy once again the taste of natural food (or, at least, what it seems to be "real food" to those people who ignore the truth).

The second solution is the inclusion of certain "unconventional species" in the menu. In the introductory scene of *Mad Max: Fury Road* (2015), the protagonist crushes a lizard with his foot and then he eats it raw. In the film *What Happened to Monday* (2017) rats are openly sold in the market as source of food, while in *Snowpiercer* (2013) the gelatinous protein bars received by the people who live in the tail of the train is, actually, made of pressed cockroaches. In other terms, the number of species considered edible might significantly grow in a future state of emergency.

The third (most extreme) solution is to embrace cannibalism as a life-choice for facing the threat of starvation. Some examples are movies like *Hell* (2011), where human beings are chained as livestock, *Doomsday* (2008), where a group of marauders who are confined in a quarantined Scotland hunt and eat their human preys, and *The Road* (2009), where

streets are controlled by gangs of criminals who regularly practice cannibalism.

So, in time of despair drastic solutions could be implemented: they might range from the consumption of "unconventional" nutritional sources, such as artificial food, rats and insects, to the acceptance of a radical practice like cannibalism.

Reality

At the 1996 World Food Summit the concept of food security was defined as the condition that 'exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.' (FAO 1996, point 1). In order to progressively achieve food security, one of the objectives of the United Nations Millennium Development Goals (UN 2000, Goal 1 Target 1.C) was to 'halve, between 1990 and 2015, the proportion of people who suffer from hunger.' In spite of a series of unexpected challenges (such as, for example, volatile commodity prices, world economic crisis and natural disasters) this objective was (almost) reached: the proportion of undernourished people in the developing regions felt from 23.3% to 12.9% (UN 2015, 20). However, according to the World Food Programme (WFP n.d.), 795 million people in the world still suffer hunger and one person out of three is affected by malnutrition. Only slightly different are the numbers offered by another report (FAO, IFAD, UNICEF, WGP and WHO 2018), which estimates that 821 million people in the world suffer undernourishment. Among them, there are over 90 million undernourished children under five and 151 million children of the same age who suffer

of stunting due to poor nutrition in-utero and early childhood (UN 2015, 58; UNICEF/WHO/World Bank Group 2018, 5). Approximately 90% of them live in Southern Asia and sub-Saharan Africa. Being aware of such numbers, the fight against hunger is one of the main priorities of the international community. The objective, as clearly stated by former United Nations Secretary-General (UNSG) Ban Ki-moon (2012) is that 'in a world of plenty, no-one – not a single person – should go hungry.'

At the Second World Water Forum, conducted in The Hague from 17 to 22 March 2000, the Global Water Partnership (2000, 12) defined the concept of water security as the condition that exists when 'every person has access to enough safe water at affordable cost to lead a clean, healthy and productive life, while ensuring that the natural environment is protected and enhanced'. Positively, the objective of the United Nations Millennium Development Goals to 'halve, by 2015, the proportion of the population without sustainable access to safe drinking water' was successfully achieved in 2010 and further improved in the following 5 years: between 1990 and 2015, 2.6 billion of people gained access to improved drinking water (UN 2015, 58). Negatively, the United Nations estimates that '783 million people in the world still do not have access to clean water and over 1.7 billion people are currently living in river basins where water use exceeds recharge' (UN n.d.). But water is not only a fundamental source for human hydration, but also an indispensable asset for socio-economic development. Farming, agriculture and industrial production are all activities that require substantial amounts of water in order to be regularly performed. Still,

water scarcity 'affects more than 40 per cent of people around the world, and it is projected to increase' (UN 2015, 55).

On the whole, these data highlight how, in spite of the great progress reached so far, the problem of hunger and thirst are still urgent for millions of people in the world. As in the dystopian movies mentioned above, these people are struggling for their survival. For this reason, the United Nations Sustainable Development Goals (2016) have re-proposed among their objectives to end hunger (goal 2) and ensure access to water for all (goal 6). The question remains: what are the deep-rooted causes of hunger and water scarcity in the world?

Food and water scarcity: causes

As claimed by Munir Hanjra and Ejaz Qureshi (2010, 367-368), multiple factors have recently affected global food production, including water scarcity, climate change, high energy prices, the 2008 credit crisis, an overall reduction of arable land, a widespread decline in soil fertility and scares investments in agricultural research. Still, differently from most of the dystopian narrative, the current problem of hunger seems more related to inconvenient human choices rather than a concrete shortage of food. According to Oxfam (2018), 'the world produces 17% more food per person today than 30 years ago.' Potentially, the world is already able to produce enough food for over 9 billion people (FAO 2017, 5). However, there are three problems to consider. First, a sustainable and inclusive production of such an amount of food requires deep-rooted transformations (FAO 2017, 5). Second, approximately one third of the food annually produced in the world for human consumption – roughly 1.3 billion tonnes – gets spoiled

or is wasted (FAO 2018). Third, the problem of hunger does not seem primarily related to food scarcity, but rather to its distribution and accessibility.

According to Frances Moore Lappé, Joseph Collins and Peter Rosset (1998, 4) 'the root cause of hunger isn't a scarcity of food or land, it's a *scarcity of democracy*'. In other words, the decision-making processes in the framework of food control, land ownership, distribution of public resources and international commerce are currently grounded on anti-democratic patterns. Therefore, if the objective is to fight hunger, then the world needs to introduce some reforms aimed to horizontally extend rights and responsibility over the ownership of productive resources (ibidem, 175). This basic idea was already expressed by Griffin (1987, 18) who identified poverty, here interpreted as the insufficient purchasing power of certain groups of people to daily acquire a sufficient amount of food, as the leading cause of hunger. This might be the reason why the most effective measures of food security are not those focused on the implementation of feeding programs, but rather those aimed to reduce poverty by increasing employment and opportunities for the most disadvantaged people. (Barrett 2010, 827) Therefore, the rising perception is that 'hunger is caused by poverty and inequality, not scarcity' (Holt-Gimenez et. al. 2012, 595). These arguments seem to generally support the portrayals of the causes of food scarcity proposed by *The Hunger Games* (2012) and *Snowpiercer* (2013).

Nevertheless, human and natural catastrophes are also potential trigger conditions for food insecurity. In the events of war or natural disasters, food insecurity is often related to

physical scarcity or accessibility of edible food. For example, a 2017 United Nations report claims that 20 million people across Yemen, South Sudan, Somalia and Nigeria are at risk of starvation (UN 2017). This might be the largest humanitarian crisis since 1945 (Al Jazeera 2017). The aid organization Save the Children (2018) estimates that 85,000 children under the age of five may have died from starvation since the blast of the Yemeni war in 2015. In some circumstances, civilian starvation has also been intentionally used by armies as a military tactic to impose their will. Examples go from the siege of Leningrad to the application of sanctions during the 1990 Gulf War (Thomas 2005). Likewise, natural disasters can further deteriorate the availability of food in poor countries. For example, in the last ten years Haiti suffered a devastating earthquake (2010) and a category four hurricane (2016) which severely decrease food availability. As a result, half of the country's population is nowadays undernourished (WFP 2018).

As shown by these examples, war and natural hazards are factors that might lead to overwhelming humanitarian crisis. Still, their whole impact on world food insecurity seems relatively limited: as reported by FAO (2006, 78), 'natural and human-induced catastrophes… are currently responsible for 10 percent of all hungry and malnourished people in the world; 90 percent of the hungry suffer from chronic malnutrition.' Therefore, the connection between natural or human induced disasters and the issue of famine, as proposed by movies like *The Road* (2009) and *Interstellar* (2014), is quite realistic, but it does not (arguably) represent the primary challenge of contemporary food scarcity.

The issue of water scarcity – a condition where the demand of water exceeds the available supply – seems grounded on a variable combination of three different factors. In the first instance, the problem is a physical lack of water due to the progressive exhaustion of surface and groundwater resources. For example, around one-third of the population of China and India live in regions that 'do not have sufficient annual water resources to meet reasonable per capita water needs for their rapidly expanding populations' (Seckler, Barker and Amarasinghe 1999, 37). This is commonly perceived as the most complex water-security challenge because the core of the problem is related to inhospitable environmental conditions. Vulnerable communities affected by physical water scarcity are often forced to migrate for surviving, unless radical interventions on the surrounding environment are taken.

In other cases, water resources are potentially available, but they cannot be utilized because of inadequate investments in essential infrastructures and technologies. This condition, commonly called economic water scarcity, characterizes different areas of Africa, Latin America and South-East Asia (International Assessment of Agricultural Science and Technology for Development 2008). A third problem is related to the mismanagement of available resources. An example is the Aral Sea, once the world's fourth largest inland lake. As a result of ruinous irrigation projects, where once there was a huge lake of 68,000 km^2 now there is an immense desert with two separate small lakes (Micklin 2007). So, in these last cases the problem is mainly associated with technical-political failures rather than to a physical lack of water resources.

Overall, dystopian movies tend, therefore, to offer some blurred, but convincing references to the three most important causes of water scarcity. The problem of a physical lack of water is, basically, a constant of all movies dealing with this theme, while the issues of economic water scarcity and water mismanagement are covertly explored by movies like *Tank Girl* (1995) and *Young Ones* (2014). As main limit, the identification of the causes of draught is, most of the time, just an expedient to justify the context of the story: only in a few circumstances the narrative proceeds with articulated critical reflections on the matter.

The conflicts for vital resources

Dystopian movies suggest that a long-lasting condition of water and food scarcity would inevitably lead to a spread of violence. In this regard, several authors have examined the relation between the mismanagement of transboundary water resources and the risk of violent conflicts. There are three main potential causes of transnational water conflicts: rivalries over the use of a limited quantity of water, clashes over those processes that entail a water quality degradation (e.g. pollution or contamination of water resources), and disputes on the timing of water flows, for instance, in response to the construction of a dam by an upstream country (Wolf et al. 2005, 81). Different researchers publicly sustained that water wars are going to become a leading condition of the 21st century. For instance, by critically assessing the Asian framework, Brahma Chellaney (2016) concluded that 'at a time of widespread geopolitical discord, competition over freshwater resources could emerge as a serious threat to long-term peace and stability.' Moreover, the Pacific Institute (n.d.) published in its web-site a chronological list of conflicts over

water resources, with some of them degenerating in episodes of limited violence.

Anyway, there are also many other authors who do not share these fears. For example, Wendy Barnaby (2009) claims that the notion of "water wars" is nothing more than a popular myth that needs to be dispelled. On the base of her studies on more than 1,800 interactions over freshwater resources, this author claims that states are much more prone to cooperate rather than compete on water issues, a position supported also by Thomas Bernauer and Tobias Segfried (2012). While they recognize the regular rise of international disputes over water resources, they argue that 'none of these disputes has thus far escalated into a militarized interstate dispute in a form that would, according to common definitions, qualify as war' (Berneuer and Segfired 2012, 237). So, looking at the historical data, the risk of water conflicts seems overestimated by dystopian movies.

However, to date 'around two-thirds of the world's transboundary rivers do not have a cooperative management framework' (UN-Water n.d.). Moreover, even though in the modern era clashes over water resources have never turned into interstate wars, this does not exclude that they might exacerbate already existing tensions between neighbouring countries. For example, in 2012 talking about the Kyrgyz and Tajik hydropower dam projects, the then President of Uzbekistan, Islam Karimov stated: 'today many experts declare that water resources could tomorrow become a problem around which relations deteriorate, and not only in our region. Everything can be so aggravated that this can spark not simply serious confrontations but even wars' (Karimov cited in Putz

2015). Likewise, the construction of the Grand Ethiopian Renaissance Dam (GERD) is raising up tensions between Egypt and Ethiopia. Although both parties repeatedly claimed the need to find a common solution, in 2017 the Egyptian President Abdel Fattah al-Sisi declared: 'we are capable of protecting our national security and water to us is a question of national security' (The New Arab 2017). A further case is related to the management of transboundary rivers between Iran and Afghanistan. In this case, Sudha Ramachandran (2017) reports allegations over an Iranian support to Taliban groups with the objective of sabotaging the construction of the Kamal Khan Dam on the Helmand river in Afghanistan. Therefore, while historical data show how cooperation tends to widely prevail over violence, the threat of escalating tensions over water resources is a rather common practice in international relations.

This risk of escalating tensions over water resources might further increase in the near future due to the combined effects of world population growth and global warming. A growing demand of water accompanied by a lowering supply could foster new scenarios of conflict. Consequently, as claimed by Sandra Postel and Aaron Wolf (2001, 65): 'History supports the hopeful notion that fresh water may foster cooperation more often than conflicts in the year ahead… But the unprecedented degree of current water stress is creating more zero-sum situations – in which one party's gain is perceived as another's loss – both within and between countries.' In other terms, the idea is that, in the eventuality of future worst-case scenarios, the pessimistic predictions proposed by movies like, for example, *The Last Survivors* (2014) and *Mad Max: Fury Road* (2015) could turn into reality

notwithstanding the optimistic record which emerges from the analysis of the historical data. But is really the conflict inevitable as suggested by dystopian movies?

Different sources disagree with such cynical statement. Still, preventing the rise of water conflicts would require the adoption of various measures both at the national and international level. Domestically, a leading condition to success is the development of an integrated water management strategy aimed to balance resource consumption and environmental preservation (Vörösmarty et al. 2010, 555). The development of a sustainable system of water management might reduce the risk of facing extreme conditions of water scarcity. For developing countries, a major challenge could be to collect the required resources and to invest them in successful projects. However, there are several non-governmental organizations (e.g. Charity: water, Clean Water Fund and the Water Project), academic institutions (e.g. the International Water Management Institute and the Stockholm International Water Institute) and international organizations (e.g. UN-Water and the World Bank) that offer different levels of assistance in this process.

Internationally, the development of an effective transboundary water management can provide opportunities and benefits to all the parties at stake, thus preventing the potential blast of violent conflicts. This condition can be achieved through an active implementation of conflict-resolution mechanisms and adequate investments in institutions aimed to regulate transboundary water resources (Peterson-Perlman, Veilleux and Wolf 2017). For example, in the case of the Cubango-Okavango River Basin the

transboundary cooperation among Angola, Botswana and Namibia led to a number of benefits including conflict avoidance, improved livelihoods, ecosystem conservation and tourism development. (UNECE 2018, 3) Therefore, despite being complex issues, transboundary water disputes can be technically addressed and solved through national and international practices of good governance (WEF 2011).

In the last decade, several academic studies have been aimed to assess the role of food shortage over the blast of violent conflicts. Most of researchers recognize that a condition of prolonged food scarcity may favour an escalation of tensions and, finally, blast into violent behaviours. The fact that, in 2017, all the nineteen countries classified by FAO in a state of "protracted crisis" were also experiencing violent conflicts has been, *inter alia*, used to support the perspective over a positive correlation between food insecurity and violent conflicts (Brück and d'Errico 2019).

Still, the link between food scarcity and violence seems context-specific, which means that food insecurity heightens the risks of a violent escalation, but it 'is neither a necessary nor a sufficient condition for acute political violence and conflict' (Brinkman and Hendrix 2011, 4). For example, studying the reasons why the global food crisis of 2007-08 fomented episodes of violence in only some countries of Africa, Julia Berazneva and David R. Lee (2013) discovered that a number of specific factors (such as, for instance, higher levels of poverty, limited availability of food, extended urbanization, coastal location, more oppressive regime and strong civil societies) increase the chances of unrests.

As a result, researchers are, nowadays, primarily trying to reveal new insights about how the interrelation between food scarcity and other intervening factors might degenerate into violence. For instance, according to Brinkman and Hendrix (2011), multiple contingent factors may enhance the food insecurity's effect on the rise of violence. Among them: young societies in a context of high unemployment, systemic ethnic discriminations, hybrid political regimes, low levels of economic development, economic shocks and high rates of economic inequality across groups. Likewise, Charles P. Martin-Shields and Wolfgang Stojetz (2019) have examined the issue of endogeneity concerns: the complexity of "unpacking" the national intervening factors which affect the relation between food security and conflict. Among the factors intimately related to food insecurity as well as to the likely rise of violent conflicts there are, for example, the national income and the national administrative capacity of a country.

Overall, there are enough qualitative and quantitative studies supporting the existence of a positive correlation between food scarcity and violence. In contrast, validating the presence of a causal relation between these two variables and assessing how the multiple intervening factors relate to each other is still an open challenge. On the base of these considerations, the idea that, in a post-apocalyptic context, food insecurity may foment an uncontrolled spread of violence seems a reasonable outcome even if, as shown here above, multiple elements should actually be taken into account and some doubts remain unsolved. This means that the general framework of violence presented by movies like *The Road* (2009), *This Is the End* (2013), and *The Survivalist* (2015) is quite simplistic, but nonetheless plausible.

The adoption of drastic solutions to face hunger

Finally, some dystopian movies offer drastic solutions for the problem of hunger, which include the consumption of artificial food, insects and human meat. So far, none of these options has been really implemented as a solution for achieving food security in the world. Supplementary pills and nutritional powders are regularly sold in the market. However, the speculation that they might substitute conventional meals proved to be wrong. The same consideration is valid for other curious innovations recently introduced in the culinary sector. For example, molecular gastronomy and 3D food printing are – at least so far – viewed more as sophisticated ideas for exclusive restaurants rather than pioneering solutions to food scarcity. So, daily lunches of synthetic pulp – as in the film *Matrix* (1999) – are not yet on the horizon although they might become more popular in the future with the raise of new tendencies in the culinary field.

Slightly different is the issue over entomophagy, which is the use of insects as nutritional resources. In some regions of Latin America, Asia and Africa insects are already perceived as traditional culinary products, but their use in cuisine is still a taboo in many other areas of the world. Nevertheless, a rising demand of food due to a steady world's population growth might change this condition. Multiple authoritative voices prospect a future where insects production and consumption might become a worldwide trend. (van Huis, Dicke and van Loon 2015, 3). Companies such as FlyingSpArk, All Things Bugs and Grub are already making investments in this field. Moreover, FAO (n.d.) is currently trying to publicly spread information about the environmental, health and social

benefits related to a regular use of insects as food for humans and feed for animals. At the moment, the main barrier to the spreading of entomophagy is still the sense of disgust and repulsion that many potential consumers feel over the idea of eating beetles, caterpillars and flies. But circumstances might change in the next future due to the necessity to introduce more sustainable policies and alternative nutritional resources. Eventually, eating gelatinous bars made by pressed cockroaches – as shown in *Snowpiercer* (2013) – could become, one day, a common practice.

Concerning the consumption of human flesh as answer to food scarcity, ethical and legal implications have fortunately confined this option to the realm of fiction. Occasionally, mass media report acts of cannibalism from areas of conflict (e.g. Miles 2018; Lloyd Parry, 1999). However, there are no evidences suggesting that such acts were specifically driven by food shortage. Moreover, ethics and morality would plausible constrain the diffusion of a similar practice in society. Therefore, the use of cannibalism as a solution to food shortage – as revealed in dystopian movies like *Hell* (2011) and *The Road* (2009) – is still, fortunately, only a repulsive and shocking idea of fictional plots.

Final remarks

The lack of food and water is a serious problem that affects the live of around 800 million people in the world. Like in *The Hunger Games* (2012) and *Snowpiercer* (2013), the problem of hunger seems more related to poverty and the unequal distribution of resources rather than to physical scarcity of edible resources. The main exception is the problem of

starvation related to contexts of wars or natural disasters. In these circumstances, the effective absence of edible food is a key issue. Therefore, the connection between natural or human induced disasters and the issue of famine, as proposed by movies like *The Road* (2009) and *Interstellar* (2014), is also rather realistic even though it is pushed, in these stories, to extreme levels that the world has not yet experienced.

Differently, the case of water shortage can be related to different factors like physical water scarcity, economic water scarcity and water mismanagement. Each of these conditions implies different risks as well as different solutions. Dystopian movies like *Tank Girl* (1995) and *Young Ones* (2014) tentatively examine the challenge of water issue, but their underlying analysis tend to be simplistic and, at times, inaccurate.

The idea that a lack of water might escalate tensions and conflicts, as shown in movies like *The Last Survivors* (2014) and *Mad Max: Fury Road* (2015), seems to have some reliable basis. In the next future, the rising pressure on water resources due to climate change and demographic growth might further exacerbate the problem. However, evidences collected by research demonstrate that in the current international system states tend to cooperate over the management of transboundary water sources rather than wage war. Likewise, the inevitability of a direct clash for water resources seems to be confuted by data.

Academic researchers commonly believe in a positive correlation between food shortage and the likelihood of violent conflict occurring. However, the link between food scarcity and violence seems context-specific. Therefore,

multiple political, economic and social intervening factors need to be addressed in order to have a more precise and clear understanding of the phenomenon. Still, the general framework of violence determined by a prolonged unavailability of food – as presented by movies like *The Road* (2009), *This Is the End* (2013), and *The Survivalist* (2015) – is a rather conceivable scenario.

Finally, most of the various drastic ideas proposed by dystopian movies as solutions to the problem of hunger are unlikely to be globally used in the short-term. The sole possible exception might be entomophagy. However, this practice will have to overcome resisting cultural and psychological barriers before turning from a regional to a worldwide custom.

Chapter 3: Overpopulation

Fiction

The risk of an overpopulated world is a recurring theme in dystopian movies. Generally, these movies do not provide precise numbers about the future demographic growth. However, at the beginning of the movie *Pandorum* (2009) an opening crawl text reveals that, in 2153, world population will pass quota 24 billion people. As a result, the colonization of other planets will be deemed as the only solution for human survival. Ironically, the comic-sci-fi movie *Idiocracy* (2006) suggests that an overpopulated world might be the result of a long-term evolutionary process that will favour dumb people compared to intelligent ones. The rooted reason is that clever people tend to have few or no children because they are concerned with the related costs and future opportunities of their offspring. Differently, thick people continue to reproduce endlessly without thinking about the effects of their actions. Therefore, according to the movie, the final result will be a world (over-)populated by idiots.

Regardless of the possible causes of overpopulation, three main problems are generally considered in dystopian movies. First, the bounds on demographic growth dictated by the limited availability of resources in the world. Second, the identification of solutions to counter the risk of overpopulation. Third, an unexpected rise of infertility rates that might threaten the survival of mankind.

Overpopulation and societal collapse

Many dystopian movies sustain the idea that an overpopulated world will be unsustainable. The first scene of the film *What Happened to Monday* (2017), for example, provides a glimpse of what could occur in an overpopulated society. The first visible effect of a never-ending demographic boom would be the overconsumption of natural resources and an unprecedented emission of fossil fuels. These changes would cause the annihilation of the Earth's environment and trigger an intensification in the frequency and power of extreme natural hazards. In this fragile ecosystem, many people would die for starvation and diverse areas of the world would turn into a wasteland. The cultivation and consumption of genetically modifies crops could temporarily mitigate the problem. In the long-term, however, they would actually worsen the situation by provoking a spike in multiple births and genetic defects. The institution of a one-child policy will be than viewed as the sole effective solution to such never-ending crisis.

Similar concerns are shared by other movies. For instance, in *Avengers: Infinity War* (2018), Thanos (the villain) claims that the only possible outcome of overpopulation is a societal collapse. Likewise, in the movie *Inferno* (2016), Bertrand Zobrist (the antagonist) sustains that, unless drastic measures will not be taken, demographic growth will lead to the extinction of the whole human civilization. So, the core idea is simple, but clear: a world (or universe) with finite resources can only be inhabited by a limited number of people, otherwise the consequences are going to be nefarious for all.

Halting overpopulation: increasing deaths or restricting births?

Considering the dramatic premises explained above, several dystopian movies have focused the attention on the design and implementation of effective measures aimed to keep under control the demographic boom. Overall, two types of solutions are commonly examined by dystopian movies: on one side, an artificial increase of the human death rate; on the other, a forced restriction of the freedom to breed. Both of them, however, present ethical weaknesses as well as practical pitfalls.

Different are the means proposed by dystopian stories to reduce the number of people living in the world. For example, in the movie *In Time* (2011) people have been genetically modified to age up to 25 years and afterwards they have just one further year of life. If they want to survive, they have to purchase additional time, which has become the new currency. However, those who control the economic and financial system secretly operate to artificially keep the "time-currency" limited, thus ensuring that poor people keep dying. A severe and detached rationality guides such a drastic measure: with too many people in the world desiring to live forever (or, at least, as long as possible), extreme choices need to be made to prevent the impending risks of overpopulation. Another provocative example is proposed by the film *The Purge: Anarchy* (2014), where the American government introduces the "Purge" – a single night per year in which all crimes are legalized. Officially, this measure aims to satisfy people's "natural desire of violence", thus drastically reducing the rate of criminality in the remaining year. In fact, its secret goal is to keep under control the demographic level as well as

the redistribution of wealth. It is interesting to notice how both movies denounce the unfairness of similar measures: people at the margin of societies will be the primary victims, while the richest elite groups could even gain some benefits through the exploitation of such radical policies. The resulting class-struggle seems almost inevitable.

The second solution is to reduce the number of births by strictly regulating the process of pregnancy. In the movie *Fortress* (1992) a one-child policy is imposed on the entire American population as form of birth control. Those who violate the law are arrested and condemned to spend many years in a maximum-security prison. The same policy is adopted by the Child Allocation Bureau in the film *What Happened to Monday* (2017) as a solution to face a worldwide crisis due to the combined effects of overpopulation and climate change. But, here, particular attention is put on the issue of unregistered people. According to the law, every family has the right to grow only one child. In case of multiple births, all the children, but the eldest one, are officially put into cryogenic sleep (actually, they are asleep and then incinerated in the Child Allocation Bureau labs). For irregular children the chance of developing a proper life is restricted by law. As a result, they are forced to live in hiding. The movie presents the whole system as a paradox: on one side, the promise for a better world, on the other the use of massive monitoring and extreme violence to accomplish it. The underling question is: to what extent humanity is willing to abandon its fundamental moral principles in order to secure itself a brighter future? A partial answer is offered in the movie *A.I. – Artificial Intelligence* (2001), where the initial narrating voice claims that, in the next future, many

governments will introduce legal sanctions to reduce pregnancy as a strategy to maintain prosperity in an era of scarce resources.

Finally, a brief mention is for the colonization of space as the sole concrete solution to the problem of overpopulation and resource scarcity. This idea has been regularly proposed by a number of dystopian movies. A few examples are *Red Planet* (2000), which suggests the terraforming of Mars, *Elysium* (2013), which prospects the construction of a habitable orbital settlement, and *Interstellar* (2014), which envisages the colonization of intergalactic planets. Despite some technical differences, the underlying message of all these movies is that humanity might desperately need a backup Earth to survive. However, although being a tempting and, eventually, successful idea (*Interstellar*), unexpected events (*Red Planet*) and unfair policies (*Elysium)* might turn it into an unwelcome reality.

Infertility and human extinction

Overall, the issue of overpopulation tends to dominate the dystopian movies scene from a demographic perspective. Nevertheless, there are also some dystopian films which forecast a sharp rise of human infertility rate. The resulting population decline will completely change human society and, in extreme cases, it will even lead to the risk of human extinction. For example, pollution is the reason behind the 99% level of human infertility in the film *The Handmaid's Tale* (1990). After a period of indoctrination, the identified fertile women are given to élite couples as concubines for generating a baby for them. In *Aeon Flux* (2005) the assumption of a vaccine against a deadly virus turns the entire population

sterile, thus making cloning the only option to preserve human survival. In *Children of Men* (2006) infertility is so pervasive that the world does not register any births for 18 years. Somehow this movie creates a parallelism between infertility and social decay (represented, for example, by acts of terrorism, migrant detention camps, and diffused cruel behaviours) as if a world without a future generation is doomed to fall into chaos. Therefore, the discovery of a young pregnant lady will raise new hopes, but also many turbulent reactions.

To sum up, there are three critical points raised up by these dystopian movies. First, an overpopulated world might turn the life on Earth unsustainable. Second, drastic measures might be required to counter such risk unless space colonization would not become an imminent reality: on one side, the organization of a subtle system aimed to increase the mortality rate; on the other, the imposition of forced measures aimed to restrict the freedom to breed. Third, a significant increase in the human infertility rate might put at risk the survival of the human race and completely transform social relations.

Reality

At the beginning of the 20th century there were 1.5 billion of people in the world. Nowadays (October 2018), the world is inhabited by approximately 7.6 billion people (Worldometers 2018). Data shows that 'between 1900 and 2000 the increase in world population was three times greater than the entire previous history of humanity' (Roser and Ortiz-Ospina 2017). This massive and rapid increase in world's population begun

around 1800 and achieved its peak in the mid-1960s, when the annual population growth rates – the difference between the birth and death rate – reached levels over the 2% (Lee 2003, 178-180). The demographic transition model explains such demographic boom as the first phase of a secular process of transition, which is characterized by a significant decline of the death rate – due to progressive improvements in healthcare and sanitation – and high levels of birth rate (Bongaarts 2009). The resulting reduction of casualties, in association with steady birth rates, produced the skyrocketing population growth observed in the second half of the 20th century.

However, since the 1980-90s the world population growth rate has faced a noteworthy declining phase. The global average number of children per woman decreased from 5 to 2.5 in the period between 1965 and 2015 (Roser 2016a). Different theories have been developed to explaining this change. According to the economic theory of demographic transition this outcome is the result of the negative correlation between fertility and socio-economic development (Willis 1971). In other terms, at the origin of such declining trend there are some core factors: first, a rising acknowledgement of the higher infant survival rate – between 1990 and 2015 the global under-five mortality rate has been more than halved; second, a more widespread participation of women in education and labour force – over the last 25 years the gender gap in youth literacy has been significantly reduced and a positive trend has also been observed in women's accessibility to a paid employment; and, third, a general increase of families' income levels – in the developing regions, the number of people belonging to the middle classes have

nearly tripled between 1990 and 2015, representing now almost half of the whole working force (UN 2015a; UN, 2015b, 87-118). Therefore, the core idea is that the registered decrease in the global average number of children per woman is attributable to an overall increase in the number of wealthier, more educated, and employed women, who live in a framework where infants have high chances of surviving.

Other theories focused the attention on different elements such as, for example, socio-behavioural factors (e.g. marriage patterns, religious rules and family structure), micro-economic variables (like, for instance, budget constraints and distribution of time), or psychological aspects such as, for example, how much a new born baby can satisfy a series of "personal needs" (De Brujin 2006). Still, all these theories seem to share the idea that the world has entered in the second phase of demographic transition, where the total number of people in the world is still growing, but the growth rate is progressively declining due to a lower birth rate.

As a result, a common forecast is that the world population will likely reach 11 billion people by the end of the 21st century (Roser 2016b). However, these long-term estimates are highly volatile because numerous variables may intervene in the process with unexpected results. Considering this limit, the United Nations (2017) developed both a low demographic growth forecast and a high demographic growth forecast. The final prediction is that the world population will plausibly range from 9.6 to 13.2 billion people by 2100 (UN 2017, 3). Unsurprisingly, the population growth is not going to be equally distributed worldwide: most of the upcoming population growth is going to take place – as it is happening

nowadays – in developing regions, while the overall population of developed regions is likely to remain around 1.3 billion people (UK Ministry of Defence 2014, 3).

Even assuming that these estimations are correct and the world population will reach approximately 11 billion people by 2100, there is a further key question to consider: would this demographic boom represent a threat for human existence? Or, in other terms, is the Earth's carrying-capacity limits doomed to be reached and passed by due to the inevitable rising demand of natural resources caused by the ongoing global population growth?

Overpopulation and societal collapse

In 1798, Thomas Malthus introduced the idea that a world with limited resources would be able to support only a certain limited number of people (Malthus 1798). Since then, the issue of the Earth's carrying-capacity limits has been the object of a heated debate. On one side, authors like Frances Moore Lappé, Joseph Collins and Peter Rosset (1998, 13) claim that, on the base of the future population projection, available food supplies are 'well within what most experts view as the capacity of the Earth.' In other terms, the problem is not overpopulation itself, but rather those human actions producing environmental degradation, overconsumption and waste. On the other side, Simon Ross (2011, n.d.) affirms that 'indefinite growth was never going to be possible in a finite world; the time to apply the brake has arrived.' The resources available on the Earth are limited and some of them are not renewable. Therefore, believing that demographic growth could rise endlessly is viewed by many as a paradox. This

perspective clearly supports the premises of the movie *What Happened to Monday* (2017).

Still, assessing if in 2100 there will be enough resources for everyone might be a much more complex matter than a mere "quantitative issue". During an interview for the BBC, David Satterthwaite (cited by Cumming 2016) stated that both the number of consumers as well as the nature of consumption should be taken into account in addressing the resource issue. In other terms, any serious calculation about demographic growth and resource availability cannot ignore the direct relation between consumption and living standards. Even with a limit in the availability of resources, changing certain common practices (from reducing consumerism and increasing recycling to more radical choices such as, for example, spreading the consumption of insects as standard culinary resources) might make a huge difference in the levels of sustainability. Acknowledging this factor is crucial because it reveals that overpopulation does not inevitably cause societal collapse as claimed by the antagonists of movies like *Avengers: Infinity War* (2018) and *Inferno* (2016). However, this same condition also makes more difficult to formulate reasonable predictions on the matter.

Halting overpopulation: increasing deaths or restricting births?

Even recognizing that the combined effects of global population growth and climate change might effectively generate serious problems on the availability of and accessibility to fundamental resources, there is a critical question to address: what kind of specific policies should world governments apply in order to solve this problem? Any

measure aimed to increase the death rate, as shown in movies like *In Time* (2011) and *The Purge: Anarchy* (2014), seems strictly confined to the realm of dystopia. The right to life is commonly viewed as the most fundamental human right and, therefore, any restriction to this right for the purpose of facing the overpopulation challenge would be hardly accepted by the public opinion.

An alternative prospect, as suggested by *Red Planet* (2000), *Elysium* (2013), and *Interstellar* (2014), is to work around the problem by proceeding with space colonization. This is a highly-fascinating idea that could possibly undermine the threat of overpopulation. Visionary scientists like K. Eric Drexler (2006) and Michio Kaku (2018) shared the view of a next future where human beings will open the space frontier. Unfortunately, this seems a hardly-feasible prospect in the short term considering the multiple challenges that still need to be solved (e.g. the amount of fuel required to cover interplanetary distances, the detrimental effects of space travel on the human body, and the complex building of life supporting systems in other planets or orbital settlements). Nonetheless, the interest generated in far-seeing entrepreneurs such as Elon Musk and Richard Branson could significantly accelerate the required process of scientific innovation, thus turning similar forecasts from science fiction plots into ambitious plans of investment.

Anyway, to date, eventual interventions on the birth rate are often viewed as the sole residual option to reduce demographic growth and face the problem of overpopulation. According to Garrett Hardin (1968), restricting the freedom to breed – an idea revived in the above-mentioned dystopian

films like *Fortress* (1992) and *What Happened to Monday* (2017) – is a crucial condition to avoid a catastrophic socio-economic crisis due to overpopulation. At present, the People's Republic of China – the most populated country of the world with around 1.4 billion inhabitants – is the only state that adopted a "one-child policy" from 1979 to 2015. Positively, such measure has constrained the population boom in China and, in addition, it has increased the propensity of Chinese families to invest in the education of their daughters (Hesketh and Zhu 1997). Negatively, it has provoked different controversial effects like, for example, a massive campaign of forced sterilization, an increase in the number of illegal sex-selective abortions that subsequently provoked an extreme gender imbalance – 'China may have 48 million more men than women by 2045' – and a significant rise of unregistered babies, which has been estimated to be around 13 million (Phillips 2015; UK Ministry of Defence 2014, 5; Gordon 2015).

Similarly, in India – the second most populated country in the world, with 1.3 billion citizens – 12 states opted for the application of a "two-child policy". Basically, the adopted norm excludes from any governmental position all those who have more than two children and guarantees maternity benefits only for the first two babies. However, as in the case of China, this law has been criticized for being discriminatory for young couples and women, anti-democratic, and disrespectful of fundamental human rights (The Hunger Project 2013). Therefore, the main attempts to impose restrictions to the freedom to breed have, so far, faced multiple criticisms and provoked several undesirable side-effects. On the basis of these considerations, Michael Gross (2014, R99) stated that 'the best hope for tighter population

control is probably that development will naturally reduce the family size everywhere.'

Still, there is a further underlying problem with the one-child policy: the diffused, but wrong belief that such policy might be the only concrete solution to face overpopulation. This condition brings us back to the film *What Happened to Monday* (2017) where the antagonist, Nicolette Cayman, machined a persuasive system of propaganda aimed to convince ordinary people that her restrictive family-programme is the only way to avoid catastrophic consequences. Actually, less drastic approaches have been proposed as alternative solutions for slowing down the rapid population growth of developing countries. These measures include, for example, voluntary family-planning programmes, sexual education programmes and the promotion of different contraception methods. Presumably, these measures cannot have the short-term efficacy of the "one-child policy" or the "two-child policy". However, they can gain higher acceptance by the public opinion and they might produce valuable long-term effects. For example, according to John Bongaarts and Steven Sinding (2011, 574-575) there are already enough case-studies to support that the provision of strong health and family-planning services, especially in areas where socioeconomic conditions are improving, is a highly cost-effective approach for reducing population growth. Certainly, there are still many obstacles to face for maximizing the benefits of voluntarily family planning such as a lack of knowledge of the available options, cultural barriers and misconceptions, and a restricted access to health care services. However, 'if these obstacles could be overcome and the demand for family planning met, 54 million unintended

pregnancy, more than 79,000 maternal deaths, and more than a million infant deaths could be averted each year' (Bongaarts et al. 2012, v).

Infertility and human extinction

A few final considerations on the issue of human infertility, here interpreted as 'the inability of couples to conceive a clinical pregnancy after 1 year or more of trying' (Centers for Disease Control and Prevention 2014, 4). Estimating the contemporary global rate of sterility and defining eventual historical variations in human fecundity is a complex process due to serious limits on the available statistical data as well as the need to keep simultaneously into account biological, social and behavioural factors. Nevertheless, a number of interesting researches have already been released on this topic, thus making possible some preliminary reflections.

On one side, the World Health Organizations (n.d.) reports that from 1990 to 2010 the overall burden of infertility of women worldwide remained relatively stable. On the other side, some recent studies suggest a decreasing trend in male fertility rate due to a significant decline in sperm counts (Skakkebaek et al. 2006; Levine 2017). The problem is serious because there are many potential causes of this disorder and, in addition, the available cures for infertility are often medically invasive (Centers for Disease Control and Prevention 2014, 3). Nevertheless, infertility is still confined to a relatively restricted number of people: a research estimates that there are 19.2 million couples in the world who are unable to have a first child and 29.3 million couples who are unable to have an additional child (Mascarenhas et al. 2012, 8). Moreover, reproductive medicine is making important steps forward in

fertility treatments. Nowadays, techniques like artificial insemination and in vitro fertilization are progressively becoming standards medical practices. Thanks to them, many women in the world succeeded in having a childbirth.

Therefore, infertility is a concrete and thoughtful problem that deserves the maximum attention from the medical sciences. Still, the nefarious scenario of a future world with few pregnant women or no babies at all, as depicted in the movies *The Handmaid's Tale* (1990) and *Children of Men* (2006), seems, at least at the moment, unlikely. As claimed by Professor Richard Shape, 'the end of humanity is not approaching' (Shape cited by McKie 2017).

Final remarks

Demographic studies suggest that the world might reach 11 billion people by the end of the 21st century. However, being history a non-linear process, different unpredictable events might take place along this path and reverse such prediction. Anyway, the view of a potentially endless demographic and economic growth is unconceivable and unrealistic considering that the Earth is a constrained space with limited resources. That said, there are contrasting views about the possibility to satisfy the demand of resources of a population of over 10 billion people. Beyond the quantity of available resources there are other parameters to consider such as, for example, the impact of climate change and environmental degradation on resource productions, the distribution of resources within society and the changing life styles. All these factors thwart the formulation of precise and valuable predictions. Nonetheless, in contrast with the negative statements

expressed by the villains of movies like *Avengers: Infinity War* (2018) and *Inferno* (2016), they also raise some doubts about the imminence and inevitability of a social collapse due to overpopulation.

Likewise, the issue about how to address the risk of an overpopulated world has sparked a heated debate among various factions. The core problem is that the phenomenon, by itself, is multifaceted – there are biological, socio-economic, cultural and psychological factors at stake – and, therefore, its potential solutions creates both ethical reservations and practical difficulties. The dystopian idea to systematically increase the mortality rate to counter demographic growth is a clear violation of the most fundamental human right – the right to live – and, therefore, needs (fortunately) to be discarded. Differently, some states proceeded with the implementation of policies aimed to restrict the freedom to breed like those shown in *Fortress* (1992) and *What Happened to Monday* (2017). These policies effectively contributed to a decrease in the rate demographic growth, but they also provoke a series of undesirable side-effects like, for example, illegal abortions, hidden children and an unbalanced sex ratio. The spread and enhancement of initiatives aimed to promote less drastic measures such as family assistance and free contraceptives might be a valid alternative approach to counter the problem while reducing the unexpected risks. However, these measures need to be consistently promoted, sustained and financed to be effective. Unfortunately, this rarely happens. Maybe the hope is that, one day, human creativity and cleverness will allow us to find a ground-breaking way out, as suggested in *Red Planet* (2000), *Elysium* (2013), and *Interstellar* (2014). However, ‘so long as

there is a glimmer of hope in side-stepping the problem of overpopulation by escaping to the stars, many people will refuse to grapple with the problem of adjusting to earthly limits' (Hardin 1993, 7).

Concerning the issue of infertility, this is certainly a thoughtful problem that dramatically affect the life of millions of couples. However, extreme scenarios like those shown in *The Handmaid's Tale* (1990), *Aeon Flux* (2005) and *Children of Men* (2006) are quite unrealistic according to the last available data and trends analysis. So, the world is not on the verge of extinction due to infertility.

Chapter 4: Global Pandemics

Fiction

A recurrent theme of dystopian movies is an infection outbreak that may turn into a catastrophic global pandemic. Overall, these movies offer some interesting considerations on a variety of aspects by exploring the diverse origins and mechanisms of infection of contagious diseases as well as critically assessing the weaknesses of the international practices aimed to contain an outbreak. Here, however, the attention will be exclusively focused on two aspects: first, how rapidly an infectious disease could spread in contemporary society provoking a substantial number of casualties; second, what are the risks associated with mutating dangerous viruses in scientific labs.

The deadly impact of global pandemics

One of the most common lessons of dystopian movies is that, if out of control, the effects of a global pandemic might be catastrophic. Although being a fairly obvious conclusion, different movies have stressed this idea by emphasizing two nefarious features of infectious diseases: their rapidity to spread unrestrained in contemporary human society and their high mortality rate.

In the film *Outbreak* (1995), a white-headed capuchin smuggled in the USA is the vector that transmits a virus called "Motaba" to human beings. This virus causes a deadly fever that kills the infected people in less than 72 hours. By mutating into an airborne strain, the virus rapidly infects numerous citizens of Cedar Creek in a few days. As a result,

the army quarantines the town in the attempt to contain the disease. Similarly, in the movie *Contagion* (2011) the pandemic is caused by the Meningoencephalitis Virus One (MEV-1), a virus with the ability to spread across diverse species. As revealed by a flashback scene at the end of the movie, the first contagion takes place in a restaurant of Macau when the local chef comes into contact with the carcass of a pig carrying the virus and then, without washing his hands, he disseminates it by handshaking with a customer. After that, the virus spreads through its patient zero to USA and, then, worldwide. In only 26 days such infectious disease causes the death of 26 million people. Only the discovery of a vaccine will slowly stem the pandemic.

Likewise, in the movie *The Flu* (2013) a mutated variation of the H5N1 virus (avian flu) quickly spread throughout the district of Bundang, in the suburbs of Seoul. At the peak of the epidemic, this aggressive airborne virus infects 3.4 persons per second and causes their death in 36 hours, with a 100% fatality rate. Interestingly, this movie shows how the virus rapidly circulates in the town due to a cascade of infections. When the first infected person is brought by his brother to a clinic with symptoms that, at least at the beginning, remind those of a seasonal flu, his coughing spreads the virus in the surrounding environment. As a result, other three people get infected by the released droplets of saliva. In turn, these people begin to unconsciously spread the epidemic while regularly continuing their daily activities.

Dystopian movies seem, therefore, to share the idea that, in contemporary globalized society, containing a highly infectious disease might be a challenge extremely hard to win.

Still, while recognizing the difficulties raised by a growing global connectivity and an extensive urbanization, dystopian movies are particularly critical towards those policies aimed at preventing and containing an infection. Such policies are commonly described as morally questionable and practically obsolete. In the film *Outbreak* (1995) the protagonist (a USAMRIID virologist), after having studied an outbreak of the "Motaba" virus in Zaire (now Democratic Republic of Congo), warns his superior about the risk of a pandemic. Nevertheless, his appeal remains unheard because the risk of an epidemic seems (erroneously) confined to the sole African region. As a result, when the virus reaches the USA, it provokes death and chaos.

In a scene of the movie *World War Z* (2013), the director of Mossad, Jurgen Warmbrunn, seems to suggest that one of the main reasons for similar failures might be human disbelief that induces people to procrastinate the adoption of decisive measures until something traumatic suddenly happens. This seems exactly the case of *28 Days Later* (2002). In one scene, Selena – one of the main protagonists – narrates how the evacuation of civilians from the cities affected from a highly contagious form of the virus occurred too late, when the infection was already everywhere. Therefore, the failure of containing infectious diseases is also the result of technical unpreparedness, political misjudgements and excessively time-consuming mechanisms of response.

In some dystopian movies the infectious disease spreads so much that the resulting global pandemic brings humanity to the risk of extinction. For instance, in the film *Absolon* (2003) an infectious disease halves the world population, in *12*

Monkeys (1995) a terrorist releases a lethal virus which causes 5 billion casualties, while in *Carriers* (2009) an airborne disease almost exterminates the entire world population. Obviously, these are works of fiction, dreamt up by screenwriters or the authors of the original novels, where the total number of fatalities is intentionally pushed to the extreme for narrative reasons. Nonetheless, they raise a significant question: could a global pandemic be so devastating to cause human extinction?

The risks of mutating viruses in scientific labs

In a number of dystopian movies, the pandemic is the result of viruses that have been deliberately modified in labs for medical or military purposes. For instance, in *I Am Legend* (2007) the pandemic is unintentionally generated by a genetically modified measles virus, which was originally created to cure cancer. The release of the virus provokes the death of 90% of the infected people and it causes a horrible mutation in most of the remaining 10%. Similar is the story of the "Simian Flu" in *Dawn of the Planet of the Apes* (2014). The intentions of the scientist who discovered and tested it were to find a cure for the Alzheimer. Unfortunately, the "Simian Flu" would be responsible for the death of over 90% of human population.

Differently, in the film *Resident Evil* (2002) at the origin of a zombie apocalypse there is the deliberate release of an artificial airborne pathogen (the "T-virus") during a failed attempt to steal some samples of the virus. The plot then reveals that this virus was specifically created in the labs of the Umbrella Corporation as bacteriological weapon. Despite the extreme "security measures" of the facility, the T-virus will rapidly spread worldwide through the bites of the infected

people. Likewise, in the movie *28 Days Later* (2002) a group of pro-animal activists enters into a scientific lab where dangerous experiments are conducted on a highly contagious rage virus. The final outcome will be an uncontrolled and devastating infection. The sequel of this movie, *28 Weeks Later* (2007), shows the virus spreading from UK to the rest of the world regardless the adoption of drastic measures such as, for example, the bombing of the infected areas of London.

On the whole, all these movies seem to suggest that conducting experiments on dangerous infectious viruses, even in appositely created scientific facilities, might be a terrible choice. Despite the noble purposes driving the scientific research, the critical question is if the intentional creation of pathogens that might represent an existential risk for humanity might ever be considered as a legitimate practice from an ethical perspective. Moreover, from a technical point of view, a central issue is to define how concrete is the risk that a dangerous virus might escape from a scientific laboratory and cause a devastating pandemic as those shown in dystopian movies.

Reality

There are plenty of diseases in the world. One basic way to classify them is by distinguishing between infectious and not infectious-ones. In simple terms, infectious diseases are illnesses where the pathogen can be transmitted from human to human (e.g. blood, other body fluids or faeces) or through a vector (e.g. food, water or animals). Differently, non-infectious diseases are those that cannot be transferred from one person to another. Some examples are cardiovascular diseases,

cancer, and chronic respiratory diseases. Although non-infectious diseases are a major concern for human security, causing around 40 million casualties every year (World Health Organization 2017a), this section will exclusively focus the attention on infectious diseases.

The deadly impact of global pandemics

In the course of history, human beings have suffered extensive casualties due to contagious diseases. The maximum damages were registered during epidemics and pandemics. The concept of epidemic refers to 'a sudden outbreak of a disease that is new to an area, or a sudden increase in the number of new cases of a previously endemic disease', while a pandemic occurs 'when an epidemic rapidly spreads around the world, or over a large part of the world, and strikes a large part of the population' (Youngerman 2008, 5-6).

So far, some of the most devastating pandemics in human history have been: the "Black Death", a plague that killed from 30% to 60% of the total European population in the 14th century (Alchon 2003, 21;) the 1918 "Spanish flu", which have plausibly caused around 50 million casualties between 1918 and 1920 (Johnson and Mueller 2002, 115); and Smallpox, an infectious disease which provoked between 300 and 500 million deaths in the 20th century (Saint Louis University 2008). Despite the outstanding results achieved in the field of biomedical science and regardless of the remarkable progress made in the world's healthcare systems, epidemics and pandemics are still one of the main threats to the life of human beings.

Three of the worst epidemics and pandemics, which are still significantly affecting a wide range of people in the world, are HIV/AIDS, Tuberculosis and Malaria. HIV (Human Immunodeficiency Virus) is the virus responsible for the AIDS (Acquired Immune-Deficiency Syndrome) pandemic. Once the HIV virus infects an organism it begins to destroy those cells that are responsible for the human immunity system. As a result, the capacity of the human body to naturally respond to illnesses and infections is highly compromised. According to statistics, at the end of 2015 there were 36.7 million of people in the world living with HIV: 2.1 million of them contracted the virus in that year and 1.1 million are those who, in that period of time, died from HIV-related causes (World Health Organization 2017b, 5). Since the beginning of the epidemic, which took place in the 1960-70s (but the first cases date back to a period between 1930s and 1950s), almost 78 million of people contracted HIV through sexual intercourse, transfer of blood or breast feeding. In the same period of time, approximately 35 million people died due to AIDS related diseases (UNAIDS 2016). To date, there is no cure for HIV. However, there are some antiretroviral drugs that allow to inhibit the further development of the virus.

Tuberculosis (TB) is an airborne disease whose bacilli were firstly isolated in 1998 (Mallozi 1998). The infection is spread from person to person through droplets released in the air by the disease-ridden. Tuberculosis can provoke multiple symptoms, but it is particularly dangerous when it affects a person' lungs. The World Health Organization registered around 10.4 million new cases of TB in the world in 2015. Approximately 72% of them occurred in South-East Asia and Africa. Today, most cases of TB can be cured with a prompt

diagnosis and a correct treatment. Nevertheless, 1.4 million people still died in 2015 as effect of this disease (World Health Organization 2017b, 9-11). So far, the main positive note is that from 2000 to 2015 the rate of casualties associated with TB registered a decline of 22% (World Health Organization 2016a).

Malaria is a disease caused by parasites that are transmitted from certain types of mosquitos to human beings. However, this disease cannot be transmitted from person-to-person. Generally, malaria causes an infected person fever and flu-like symptoms that can also lead to the death of the patient. In 2015, around 212 million cases of malaria were registered in the world and 90% of them took place in the Sub-Saharan African region (World Health Organization 2016b). Although between 2000 and 2015 the incidence rate of malaria has decreased of 41%, in 2015 this disease still caused 429,000 casualties.

Other recent epidemics that deserve to be mentioned are Ebola, influenza A(H1N1) and SARS. Ebola is a viral haemorrhagic fever that can be transferred through the contact with infected people's bodily fluids. Since its last outbreak, in 2014, the World Health Organization has registered over 28,000 cases of Ebola (World Health Organization 2018). In the three most affected African countries – Guinea, Liberia and Sierra Leone – Ebola caused almost 11,000 casualties. The transmission of this virus in West Africa ended in March 2016. Sadly, a new Ebola crisis outbroke in the Democratic Republic of Congo in 2018 (Medicins Sans Frontieres 2019). In only one year, the number

of confirmed cases passed quota 2,700 and the estimated casualties are around 1,800.

In 2009, a new strain of influenza A(H1N1) – also commonly called "Swine flu" – spread around the world. As for a common seasonal flu, the transmission of this virus mostly occurred from human-to-human through coughing or sneezing. The reported laboratory-confirmed deaths were approximately 16,000, but this data presumably reveals only the tip of the iceberg because for multiple reasons (e.g. costs of testing, false-negative results, symptomatic similar to other diseases, and doctors' attitude to report casualties of critical patient as due to generic "medical conditions") many cases are not reported in the official statistics (World Health Organization 2009).

SARS (Severe Acute Respiratory Syndrome) is a viral respiratory disease caused by a coronavirus, which presumably jumped from Asian palm civets to human beings. In simple terms, SARS is a severe form of pneumonia that might impede the infected people to breath on their own in extreme cases. Between November 2002 and July 2003, a SARS outbreak in China spread to different countries, infecting around 10,000 people and causing the death of almost 800 persons (Smith 2006).

These data clearly reveal that epidemics and pandemics are still a serious threat for modern society despite the incredible progresses achieved in the medical sciences. So, are films like *Outbreak* (1995), *Contagion* (2011) and *The Flu* (2013) plausible? From a scientific perspective they present numerous fallacies: from the virus that suddenly mutates into

an airborne pathogen to the identification of a miraculous cure in a few days. However, as sustained by these movies, in the contemporary globalized society characterized by a growing urbanization, a greater connectivity and a massive daily human mobility, the risk that a dangerous pathogen might rapidly widespread worldwide is probably higher than ever in history. Nowadays, approximately 55% of the world's population live in urban areas. The world urban population might plausibly reach quota 68% by 2050 (UN DESA 2018). At the peak of traffic, there can be around 16,000 aircrafts simultaneously flying around the world (Morris 2017) and international tourist arrivals reached quota 1.2 billion in 2016 (UNWTO 2017, 2). Therefore, as suggested by Joseph R. Oppong (2010, 101): 'No nation is safe from the global threat that can be posed by an isolated outbreak of infectious diseases. Human pathogens can arrive rapidly anywhere in the world.'

Likewise, some of the criticisms raised by these movies over the states' capacity to prevent and contain an epidemic are also quite accurate. For example, several studies acknowledge the importance of preparedness activities in order to offer a prompt and effective response to infectious outbreaks (Belfroid et al. 2017). This implies the formulation of professional guidelines for healthcare organizations as well as the immediate adoption of the related procedures before and during the blast of an outbreak. However, the Epidemic Preparedness Index (EPI) shows a global wide-ranging disparity in epidemic risk preparedness and response capacity: in numerous countries of sub-Saharan Africa, Central and South Asia, and South-East Asia, the national capacity to manage infectious diseases outbreaks is highly below the

recommended standards (Oppenheim et al. 2019). Moreover, in several circumstances, delays in reporting outbreaks have contributed to large-scale humanitarian crises. According to Monica Rull, Ilona Kickbusch and Helen Lauer (2015) this was, for example, the case of the 2014 Ebola epidemic in Western Africa.

Still, late responses in global disease outbreaks do not seem primarily associated with technical weaknesses in the surveillance capacity, but rather on tardive political mobilization (Hoffman and Silverberg, 2018). In many circumstances, the resulting procrastination is largely dictated by an issue of accountability: the outbreak of an epidemic is commonly viewed as a political failure of which nobody wants to take responsibility (Rull, 2015). Therefore, these studies seem to somehow confirm the fears raised in *World War Z* (2013) and *28 Days Later* (2002): countries might underestimate or even intentionally ignore the first signs of an epidemic.

A final comment about new infectious diseases and the re-emergence of old pathogens as further threats for human society. At the 2017 Munich Security Conference, Bill Gates warned the world about the risk of new catastrophic pandemics: 'whether it occurs by a quirk of nature or at the hand of a terrorist, epidemiologists say a fast-moving airborne pathogen could kill more than 30 million people in less than a year. And they say there is a reasonable probability the world will experience such an outbreak in the next 10 to 15 years' (Gates quoted in MacAskill 2017). Likewise, according to Jonathan D. Quick and Bronwyn Fryer (2018, 1), 'a new pandemic could kill more than 300 million people worldwide.

It could also reduce global GDP by 5 to 10 percent – an impact equivalent to the financial crisis of 2008.' Global warming might contribute to such hazardous scenarios by extending the action of certain viruses in previously safe areas. Moreover, by melting the permafrost, it could also expose human beings to ancient viruses and bacteria that have been frozen for thousands of years (Wu et al. 2016; Doucleff 2018). So, even if the world is not facing, right now, highly contagious and deadly viruses like those described in *Absolon* (2003), *12 Monkeys* (1995) and *Carriers* (2009), human existence could be threatened by the emergence of new viral pathogens or the re-emergence of some viruses that were believed to be extinct.

The risks of mutating viruses in scientific labs

Different medical centres in the world are not only monitoring ongoing pandemics and epidemics, but they are also conducting scientific studies to identify and mitigate the risks associated with potential future infectious diseases. Some of these lab experiments include the modification of infectious agents into more contagious or deadliest strains in order anticipate what the world might potentially face in the future. Different researchers claim that these experiments are the only way to predict how a virus might naturally mutate, thus making the scientific community ready for such instance (Fouchier et al. 2013). For example, virologist Yoshiro Kawaoka and his team conducted a controversial experiment by creating in lab new forms of the "1918-like avian virus" that might provoke a devastating pandemic should they escape the security controls. Many people and scientists called this experimentation outrageous and dangerous (Walters 2014). However, according to professor Kawaoka, these scientific

experiments offered valuable information about a potentially natural-mutation of the virus, thus favouring the preventive development of effective countermeasures (Watanabe, Zhong, and Russell et al. 2014).

Still, this kind of tests have raised serious concerns about their safety and ethical integrity (Kilianski et al. 2016). The main fear is that the viral infections tested in labs might accidentally escape or be intentionally stolen due to security fallacies. This is, actually, how dangerous viruses are unleashed in movies like *Resident Evil* (2002) and 28 *Days Later* (2002). A comprehensive article published on Reuters by Sharon Begley and Julye Steenhuysen (2012) describes the high-security measures that should be followed by any scientific laboratory making experiments on deadly pathogens. However, the same article explains how the safety-guidelines of these laboratories have no legal power and, moreover, they are open to different interpretations. Therefore, the security levels in BSL-3 and BSL-4 labs (those laboratories that study particularly dangerous biological pathogens) are not necessarily equal everywhere.

According to historical reports, in different cases infectious diseases have already escaped from scientific labs: 'between 1978 and 1999, just over 1,200 people acquired infection from BLS-4 labs around the world; 22 were fatal' (Begley and Steenhuysen 2012). Another study of Martin Furmanski (2014) reports six cases of SARS escaping, between 2003 and 2004, from virology research labs of China, Singapore and Taiwan. Fortunately, none of these cases provoke the rise of a new epidemic. A third scientific research (Merler et al. 2013) on the biosafety of laboratories working with modified influenza

viruses stunningly reveals that the 'controllability of escape events is not guaranteed.' The fact that the construction of laboratories for the analysis and study of deadly pathogens is progressively proliferating worldwide – even in countries that have few or no regulations on the matter of biosecurity – just increase the risks that something might go terribly wrong.

Resuming, genetically modifying infectious agents might be a vital step to anticipate how a virus might naturally mutate, thus making human society ready for any eventuality. The security protocols followed by laboratories that conduct experiments on deadly pathogen make unlikely the accidental escape of a virus. Likewise, stealing a sample of a viral agent is far more complicated than as shown in dystopian films. However, historical data and recent reports show that there is a non-negligible factor of risk. Therefore, the issue remains controversial and no simple answer can be supplied to the core question: do the achievable benefits of these experiments worth the related risks?

Final remarks

In several respects, the current threat of global pandemics is not as tragic as in dystopian movies. On one side, the world is not facing highly contagious and deadly viruses like those described in the movies mentioned above. On the other, tangible results have been achieved in preventing and controlling the risk that infectious diseases might spread out of control. Overall, as Hays writes (2005, 475): 'modern societies (at least those of the developed world) seem better armed against epidemics then they were in 1918 [year of the Spanish flu]'.

Nevertheless, the world is still affected by a number of epidemics, which are provoking critical outcomes in terms of infected-related casualties. In some regions of the Global South, HIV/AIDS, Tuberculosis and Malaria are one of the main causes of death. Moreover, the risk that a new global pandemic might outbreak in the next future and provoke devastating effects on human society is viewed by many as a conceivable event. Therefore, as claimed by Rochelle P. Walensky, Carlos del Rio, and Wendy S. Armstrong (2017, 1300), 'one thing is for certain: immune to politics, emerging infectious threats will continue to endanger individuals and the public.'

Positively, there are already some valuable ideas and plans for a more effective international response to epidemics and pandemics. For instance, Jonathan D. Quick and Bronwyn Fryer (2018, 5) have identified a set of seven actions for achieving what they call "an epidemic-free-world". The list of prescribed measures includes: '(1) ensuring bold leadership at all levels; (2) building resilient healthy systems; (3) fortifying three lines of defense against disease (prevention, detection, and response); (4) ensuring timely and accurate communication; (5) investing in smart, new innovation; (6) spending wisely to prevent disease before an epidemic strike; and (7) mobilizing citizens activism.' The cluster focusing on HIV/AIDS, tuberculosis, malaria and neglected tropical diseases (HTM) at the World Health Organization (2017b, 2) is actively helping countries 'to mount comprehensive and cost-effective public health responses to the complex challenges posed by infectious diseases.' Negatively, the data mentioned above suggest that much more need to be done in order to

completely counter current epidemics as well as to proficiently prevent the risk of future pandemics. Postponing the required actions might just provoke catastrophic results.

Concerning the modification of dangerous viruses in scientific labs, the main argument in support of such experiments is that they could provide important information on how to deal with a future natural mutation of these pathogens. However, research reveals that, in the past, some viruses escaped from these facilities and there is a substantial risk that similar events might occur again. Therefore, predicting the rise of a global pandemic due to the intentional or accidental release of genetically modified viruses, as shown in dystopic movies, is a clear appeal to caution: structural fallacies and human mistakes might turn such fictional scenarios into reality. Still, providing any definitive statement about the need and utility of these experiments remains a complex matter.

Chapter 5: Social Inequality

Fiction

A common feature of many dystopian movies is the prediction of a future society characterized by drastic class divisions. The image of a hierarchical social order, where the richest and most powerful dominate over the poorest and weakest, is graphically drawn by making use of different stratagems. This chapter focuses the attention on three critical factors: the diverse living conditions in the centre and periphery, the unbalanced life expectations characterizing unequal societies and the robust relationship connecting inequality with violence.

The unfair living conditions between centre and periphery

Several movies address the problem of social inequality by focusing the attention on the different living environment of privileged and vulnerable groups. For example, in *The Hunger Games* film series (2012 – 2015) the state of "Panem" is divided in 12 districts which are characterized by different levels of development. For instance, while the first district is an urbanized centre of power whose citizens live in leisure, abundance and prosperity, the twelfth district is a rural area whose people primarily survive working in a local coalmine. When the young people selected from the various districts to fight in the hunger games as tributes meet the citizens of Capitol city (the centre of political power of Panem) the material (e.g. food and technologies) and cultural (e.g. style and customs) disconnection among them fully comes to light. Likewise, in the film *Elysium* (2013) poor people live on a highly polluted Earth where food is scarce and medical care

inadequate. Differently, the richest people live on “Elysium”, an artificially created habitat in the Earth’s orbit where, in a perfect combination of natural environment and advanced technological devices, people have access to machines that can cure any disease.

A physical separation between rich and poor people is also a core feature of the movie in *Code 46* (2003), where those who are wealthy enough to own an insurance coverage can live “inside” the cities, while all the others have to stay “outside”, thus living in a degraded waste. Similarly, in the *Land of the Dead* (2005) rich people live in a luxury skyscraper in the centre of Pittsburgh, while the rest of the citizens have to conduct a harsh existence in the ghetto. This idea of different social classes belonging to different social spaces is pushed to the extreme in *Snowpiercer* (2013). In this film human survivals live on a train where the distribution of wealth is extremely unequal. The people inhabiting the tail of the train live in confined conditions, suffering starvation and violence. The élite inhabiting the front cars, instead, relish with abundance of food and many other comforts. In one scene of this movie, Minister Mason – a woman who is responsible to keep order on the train – provides a highly provocative statement by comparing the people who lives in the last cars to a shoe. As such, these people should not have the ambition of taking the position of the hat on the head of a person, here interpreted as a figurative representation of the front cars. Rather, these people should realize what is their natural position and keep it to maintain a state of order and equilibrium.

Needless to say, all these movies have presumably been inspired by the old, but always valuable film *Metropolis* (1972), where rich industrialists live with their families in advanced housing complexes with beautiful gardens, while the poor working class have to operate underground with dangerous machines. More recently the movie *Ready Player One* (2018) has touched the issue of social inequality by offering a snapshot about how it might be the life of millions of people in future slum-like cities. In a scenario characterized by poverty, chaos and environmental degradation, the majority of people try to escape from reality by spending most of their time in a virtual world. Although providing only few details, the movie implicitly reveals the existence of an extensive social gap between common people and those working for the main high-tech corporations.

Unbalanced life expectations

In some movies, the idea of extreme inequality is reflected in references to diverse life expectations. For instance, in the movie *In Time* (2011), human society is structured on a highly unequal framework where "time" has turned into the legal currency. As a result, rich people can almost live forever, while poor people have to work hard for a few hours of life and they are constantly threatened by the (artificially imposed) fluctuations of inflation. Two antithetical scenes emphasize the dramatic consequences of such unequal condition: the death of the protagonist' mother due to a rise – from 1 hour to 2 hours – in the bus fare of the ghetto; and a poker game in the fancy casino of the richest zone, where players are ready to risk hundreds of years of life in a single hand.

A similar concept is proposed in other two movies. In *Self/less* (2015) scientists developed a medical procedure called "shedding" which allows to transfer the consciousness of rich people to a new human body, thus allowing them to circumventing the problem of uncurable diseases. However, the plot of the movie would reveal that the receiving bodies are not artificially created as claimed by the company offering the shedding service, but rather they are "purchased" by people in need of money.

Finally, in the film *Repo Men* (2010) diseased organs can be replaced by bio-mechanical organs. However, for those who do not regularly pay their debt, the standard procedure imposes a forced removal of the implanted organs with the resulting likely death of the patient. The protagonist will fully understand the brutality of this system only when, after an accident, he will receive bio-mechanical organs to survive, thus becoming indebt for the rest of his life.

Unequal exposure to violent crimes

Some dystopian movies associate social inequality with the risk of violence victimization. In the film *The Purge* (2013), for example, nobody is absolutely safe. Nevertheless, the chances to survive in the night of the "Purge" – a 12 hours of unpunished crimes – are much higher for rich families, who can purchase advanced security systems, rather than for poor or homeless people, who commonly become the target of violent groups. In other term, this movie suggests the existence of a correlation between social inequality and crime victimization on the base of the simple, but logic assumption that socially disadvantaged people have less resources to invest in their security than rich people.

A slightly different interpretation is offered in the movie *In Time* (2011). In this case disadvantaged people who live in the ghetto are constantly exposed to time-robbing gangs, while the richest areas of the city are protected by armed guards and high-security systems. In this sense, the movie supports the idea that a wealthier economic status might favour higher levels of security, but it also seems to suggest that social disadvantaged people likely live in higher crime areas and, as a result, are inevitably more exposed to risks. It is also interesting to notice that, in this movie, the chances of social improvement are few or none. In addition, there is a clear tendency to depict the interests of the wealthiest people in contraposition with the interests of the poor people, as if the success of the former depends on the despair of the latter.

Reality

Many people recognize that we live in a world with considerable wealth disparity between countries. Fewer are aware that the distribution of wealth between individuals is, possibly, even more unbalanced and that the gap between the richest and poorest people of the world has already reached extreme levels. Overall, ordinary people tend to have a wrong perception of the rate of income inequality in their society as well as a misleading idea about their personal position in the social hierarchy (Gimpelson and Treisman 2015). This section aims to partially compensate this common lack of knowledge and awareness.

The notion of extreme poverty refers to people who live with less than $1.90 a day. Positively, the number of people living below the extreme poverty line has constantly declined since

1990. Negatively, poverty is a plague that still affects a huge number of people. According to the World Bank (2016b, 5), in there are around 767 million people – which means around 10% of the world population – living in extreme poverty. Moreover, approximately 2.7 billion people in the world – more than one third of the global population – live with less than $2.50 a day (UNDP 2014, 19).

On the other side, Forbes estimates that there are 2,043 billionaires in the world, whose joint assets is around $7.67 trillion (Kroll and Dolan 2017). Astonishingly, 70% of all adults in the world – 3.5 billion people – who have a wealth below $10,000 account, on the whole, for only 2.7% of global wealth. In contrast, those who have a wealth over $100,000 are only 8.6% of the adults in the world, but they account for 85.6% of total household wealth (Credit Suisse Research Institute 2017, 21-26).

Recent trends also reveal that the gap between the richest people of the world and the rest of society is further growing. As reported by the United Nations Development Programme (2016, 31), 'since 2000, 50 percent of the increase in global wealth benefited only the wealthiest 1 percent of the world's population.' As a result, if in 2000 the wealthiest 1% of population possessed 45.5% of global wealth, in 2017 such value reached quote 50.1% (Credit Suisse Research Institute 2017, 16). In other terms, this data reveals that the richest 1% owns slightly more wealth than the rest of the planet altogether. Further restricting the field, Oxfam (2017, 2) claims that the eight richest men in the world (Bill Gates, Amancio Ortega Gaona, Warren E. Buffet, Carlos Slim Helù, Jeff Bezos,

Mark Zuckerberg, Lawrence J. Ellison, Michael R. Bloomberg) 'own the same wealth as the poorest half of the world.'

These data clearly show how the actual gap between the richest and poorest people of the world has already reached paradoxical levels. Still, the problem is not only related to wealth distribution, but also to income inequality. According to the World Inequality Report 2018 global inequality has significantly grown since 1980 and, nowadays, the share of total national income related to the exclusive top 10% earners ranges from 37% of Europe to 61% of the Middle East (Alvaredo, Chancel, and Piketty et al. 2018, 5-7). Such extreme divergence in wealth and income inevitably determines completely different sets of perspectives and opportunities.

The unfair living conditions between centre and periphery

The world is getting increasingly urbanized and the number of megacities is rapidly growing. According to Mike Davies, 'the price of this new urban order, however, will be increasing inequality within and between cities' (2006, 7). The architectonical and aesthetic contraposition between city centres and slums – a slum is 'a contiguous settlement where the inhabitants are characterized as having inadequate housing and basic services' (UN-Habitat 2002) – can be viewed as a symbolic emblem of the contemporary socio-economic disparity.

Possibly, there are nowadays around 200,000 slums in the world (Davies 2006, 26). According to Hutt (2016), the largest slums are Khayelitsha (Cape Town – South Africa – estimated 400,000 residents), Kibera (Nairobi – Kenya – estimated 700,000 residents), Dharavi (Mumbai – India – estimated 1

million residents), Ciudad Neza (Mexico City – Mexico – estimated 1.2 million residents) and Orangi Town (Karachi – Pakistan – estimated 2.4 million residents). Interestingly, the percentage of urban population living in slums in developing regions is decreasing: between 2000 and 2014 it declined from 39% to 30%. However, the absolute number of slum residents is growing in time and it might plausibly reach 2 billion people by 2030 (UN-Habitat 2016; UN-Habitat 2003, XXVI).

Although being physically part of a city, a slum is often viewed by public authorities as a separate entity (UN-Habitat 2002). Most of the time, only few public resources are invested in enhancing the living conditions inside a slum. As a result, differently from the other city's inhabitants, slum residents commonly suffer a lack of improved water resources, sanitation facilities, sufficient living-space area, housing durability and security of tenure. In other terms, a slum is often a "city in the city". Aerial photos taken from different cities of the world show a shocking difference between the living conditions in the city centre and the surrounding slums. In several respects, the similarity with movies like *Hunger Games* (2012 – 2015)*, Elysium* (2013) and *Code 46* (2003) are incredible. The main problem is that such detrimental setting severely affects the living conditions of millions of people and drastically restrict their chance of social mobility.

In many states of the world eradicating urban poverty is, nowadays, viewed as a primary concern. In order to face this challenge, the Sustainable Development Goals (2016, goal 11 target 11.1) aims to ensure 'access for all to adequate, safe and affordable housing and basic services and upgrade slums.' In this regard, the UN-Habitat published a comprehensive

practical guide for slum upgrading programmes and it launched the “Participatory Slum Upgrading Programme”, an initiative meant to improve the lives of slum dwellers in 35 African, Caribbean and Pacific (ACP) countries (UN-Habitat 2014; UN-Habitat 2016a). Important slum-upgrading results have been so far achieved in Dar Es Salaam (Tanzania), Kampung (Indonesia), and Favela Bairro – Rio de Janeiro (Brazil).

So, differently from the above-mentioned dystopian movies, there are some valid attempts to upgrade the living standards in slums. Nevertheless, much still needs to be done because ‘cities are sites of new opportunities and inclusion, [but] they can also turn into sites of deprivation and exclusion’ (UN-Habitat 2016b, 71). When this happens, the gap between rich and poor tends to increase inexorably.

Unbalanced life expectations

The idea of life expectancy at birth refers to ‘how long, on average, a new-born can expect to live, if current death rate does not change’ (OECD 2018). The available data on life expectations at birth mainly shows a high disparity between countries rather than between social groups. According to the World Bank (2017), the world average life expectancy at birth was 72 years in 2016. Anyway, while the average life expectation in some developed countries like, for example, Canada, Italy and Japan is around 82-83 years, in least developed countries such as, for instance, Sierra Leone, the Central African Republic and Chad life expectation is only of 51-52 years (WBG 2017; UN 2017, 5-6). Therefore, there is a difference of over 30 years in the life expectations for a person living in Japan compared to one living in Sierra Leone.

When these data are assessed from an historical perspective it is possible to notice some noteworthy progress. For instance, the global average life expectancy at birth has registered a positive trend in the last years, growing by 5.5 years between 2000 and 2016 (WHO 2018). Although many African countries still register the lowest rates, some important results have also been achieved in this continent. In 1950, the average life expectancy in Africa was 37 years, while in 2011, it grew to 58 years (African Development Bank Group 2014, 11). These data suggest that the adoption of consistent policies supporting reasoned investments in the healthcare system as well as promoting socio-economic opportunities for the whole population can provide remarkable results in terms of life expectancy at birth. Unfortunately, however, they also indicate that only a few developing countries have adopted consistent policies in the years, while many still follow ineffective plans of action which constrain their chances of success. For example, a report of the World Health Organization (2015a) shows that there are 400 million people in the world who still do not have access to essential healthcare services.

As with the place of birth, income is commonly viewed as a leading factor of health inequality (Benzeval et. al. 2014, 52). A higher income tends to offer better opportunities in terms of life expectancy given factors such as, for example, the possible consumption of healthier food and the access to the latest medical innovations. However, a positive correlation, rather than a causal relation seems to characterize the link between social and health inequality. As revealed by the World Health Organization (2017, 13), ‘although there has been an average

increase in income inequality in both developing countries and many high-income countries in recent decades, health inequalities have not necessarily followed the same pattern.'

On the whole, these data seem to confirm that the physical and social framework in which one individual operates is a critical factor. It may influence on people's longevity by offering opportunities (e.g. advanced healthcare facilities, adequate housing, etc.) or imposing barriers (e.g. hazardous environment, inadequate sanitation, etc.) to a healthy life (WHO 2015b, 8). Although exploring creative scenarios that go far beyond reality, this is one of the critical points raised by movies such as *Repo Men* (2010) and *In Time* (2011).

Unequal exposure to violent crimes

Movies like *The Purge* (2013) and *In Time* (2011) suggest the existence of a strong correlation between social inequality and crime victimization. Interestingly, numerous studies seem to confirm such insight.

On one side, academic research claims that societies with higher rates of economic inequality tend also to register a higher number of violent crimes. For instance, an empirical cross-country and time-series study conducted by Pablo Fajnzylber, Daniel Leaderman and Norman Loayza (2002) reveals a positive correlation between income inequality and the incidence of violent crimes such as homicides and robberies. Similar conclusions have also been proposed in numerous other studies (e.g. Demombynes and Ozler 2005; Elgar and Aitken 2011).

Rationally, there are two main explanations for such insight. From an economic perspective, an environment characterized by a high rate of economic inequality may foster cases of violent crimes due to a simple cost-benefit analysis. In other terms, in a highly unequal context the benefits achievable by committing a crime could be perceived as higher than the related risks. In such a circumstance, the number of violent infractions would tend to grow unless specific interventions will not be made to change this economic calculus (Becker 1968).

Differently, the social theory points to weak social relations as the main source of the problem. People living in unequal society tend to distrust each other more, to be less participative in the community building process and to show higher hostility toward behaviours perceived as disrespectful or humiliating (Wilkinson 2004). In a competitive framework, such tendencies have a direct influence on the rise of violent actions and the risk of experiencing a crime. Martin Daly (2016, 2) seems to combine these two theories when he states that 'a local homicide rate is a manifestation of the local level of competition for scarce resources, and economic inequality is a major determinant of the severity of that competition.'

Even if the causal mechanisms directly connecting inequality and violent crimes remain largely unclear, being aware of the correlation linking socio-economic inequality and violent crimes is an important step for developing and implementing efficacious interventions. For instance, by assessing more than 2,000 municipalities in Mexico, a group of World Bank researchers reached the conclusion that, even if inequality is certainly not the only factor affecting the homicide rate of a

region, reducing inequality might also lead to a decline of crime rates (Enamorado, López-Calva, Rodríguez-Castelán and Winkler 2014).

Still, what dystopian movies suggest is that the most disadvantaged groups are those who mainly suffer from violent crimes. Some academic researchers seem to support such view. For example, a study conducted by Iain R. Brennan, Simon C. Moore and Jonathan P. Shepard (2010) included low household income among the main factors of risk for violent victimisation. By critically assessing the US crime reports from 1974 to 2000, David Thacher (2004) reached the conclusion that criminal victimization in US has become more concentrated among the poorest groups. Similar considerations have been raised by Anders Nillsson and Felipe Estrada (2006) in their research on the exposure to crimes in Sweden.

Diverse hypothesis has been raised to explain this outcome: from the likelihood that more disadvantaged people tend to live in areas with higher crime rates to the pragmatic assumption that more restricted finances lead to less investment in the systems of self-protection. Nevertheless, the social dynamics underlying the problem remain sources of debate. For instance, Tim Newbum (2016, 330) claims that 'it is the urban enclavisation – the rise of high crime, heavily policed ghettos alongside the gated, fortified communities of the wealthy – which potentially poses the greatest challenge', while Tim Hope (2001) seems to support the idea that, in late modern societies, individuals' lifestyles might be the central factor of crime risk exposure. Moreover, the relation between inequality and victimization seems affected by other variables

like, for example, the type of criminal offense and the spatial extension of the assessed environment (for example, considering the rate of inequality in a specific zone rather than an entire city). Still need to be proved, in addition, that the patterns and trends identified in the Western society are also taking place in the rest of the world. Therefore, assessing the correlation between social inequality and crime victimization remains a thorny issue.

Final remarks

In terms of social inequality, a blurred line separates fiction from reality. The gap between the richest and the poorest has reached such extreme levels that a bunch of people possess more wealth than billions of persons.

Nowadays, the most disadvantaged people of the world often live in critical conditions that are very close to the scariest scenarios offered by dystopian movies. People living in extreme poverty face severe barriers which impede them to improve their living conditions and get out of poverty. As in *The Hunger Games* film series (2012 – 2015) or *Elysium* (2013), living in a slum or in the richest area of a developed urban centre has a significant impact on the living conditions and the opportunities of social climbing. Likewise, as suggested in movies like *In Time* (2011) and *The Purge* (2013), social inequality seems to affect people's life expectancy at birth as well as the risk of crime victimization.

Anyway, differently from other global challenges, the world seems to have broadly accepted social inequality as a shocking, but inevitable consequence of contemporary

society. In the view of Daniel Dorling (2010, 1), this result is largely due to five contemporary misconceptions, which are: 'elitism is efficient, exclusion is necessary, prejudice is natural, greed is good and despair is inevitable.' Therefore, according to the same author, the first step in the fight against extreme social inequality would be to raise awareness about the groundlessness of such false principles. The truth is that, from a political perspective, inequality harms democratic consolidation (Houle 2009). From an economic perspective, inequality is a source of destabilization for sustainable growth (IMF 2017). From a social perspective, inequality undermines social cohesion (Wilkinson and Pickett 2010). On the whole, this means that 'a world in which one percent of humanity controls as much wealth as the other 99 percent will never be stable' (US President Barack Obama 2016).

Commonly acknowledging the harsh truth would make feasible the development of critical reflections about what can be effectively done. In this regard, contemporary global society looks only partially like the above-mentioned dystopian movies, where the rich and wealthy members of society are explicitly trying to keep the poor in their place. On one side, a recent research revealed that, in a society with large structural inequality, social instability and high rates of violence, advantaged individuals might support a group-based hierarchy as a strategy to secure their privileged position (Kunst, Fischer, Sidanius and Thomsen 2017). On the other side, different philanthropists, institutions and researchers are trying to reduce extreme socio-economic disparity by making donations, sustaining projects of development in unfortunate areas and raising some interesting ideas about how to face social inequality. The extreme struggle between social classes

shown in dystopian movies seems, therefore, an oversimplification of contemporary society. But it would be interesting to examine deeper the matter by assessing the extent to which the interests of the rich and the poor are effectively perceived as opposed to each other.

A few final considerations on how to face the challenge of social inequality. According to the OECD (2015) inclusive growth policies are the key factor for reducing social disparity. In particular, this organization emphasizes the importance of creating opportunities for all by intervening in four main areas: women's participation in economic life; employment promotion and good-quality jobs; skills and education; tax-and-transfer systems for efficient redistribution (OECD 2015, 16-17). Similar proposals were already lunched in 2004 by the World Commission on the Social Dimension of Globalization while working on a new way to conceive and enhance the globalization process. Specifically, the Commission called for the implementation of urgent reforms aimed to promote a fair and inclusive globalization which could provide more and better opportunities for the populations of the whole world. In the preface to the report *A Fair Globalization. Creating Opportunities for All* the members of the Commission specifically affirmed that 'as human beings, it is in our power to take a correct turn, which would make the world safer, fair, ethical, inclusive and prosperous for the majority, not just for a few, within countries and between countries' (World Commission on the Social Dimension of Globalization 2004, vii).

Still, practical interventions need to be supported by cultural transformations in order to be effective. In her book *Doughnut*

Economics. Seven Ways to Think Like a 21st-Century Economist, Kate Raworth provides a pioneering economic model aimed to meet the challenges of the XXI century by creating a just and safe space for everyone. In doing that, she identifies a path based on seven steps. The core idea is to go beyond the restrictive and over simplistic representations of the world given by classical economic theories and, rather, to embrace more comprehensive narratives, which can better define the dynamism of the international economic system. For example, she proposes to shift the attention from the "rational economic man" to the "social adaptable humans" and to embrace an "embedded economic view" – which is aimed to take into account the environmental framework in which economics operates – rather than simply focusing on a "self-contained market". By introducing these changes, it might be possible to shape a more optimistic future for humanity. Quoting her words: 'we have the technology, know-how and financial means to end extreme poverty in all of its forms should we collectively choose to make that happen' (Raworth 2017, 243). Therefore, the only lasting question is: have decision-makers an actual, concrete and sincere will to accept the costs required for constraining extreme social inequality?

Chapter 6: Authoritarianism

Fiction

From a political perspective, different dystopian movies forecast a future world where power is concentrated in the hand of a brutal authoritarian government. Most of them have been clearly inspired by George Orwell's masterpiece "Nineteen Eighty-Four". A celebratory film adaptation, titled *Nineteen Eighty-Four*, was strategically released in 1984. Briefly, in the movie *Nineteen Eighty-Four* (1984) the state of Oceania is ruled by a totalitarian government which publicly legitimizes its restrictive and punitive measures through the artificial construction of internal and external threats such as, for example, the fight against subversive groups or a procrastinated state of international warfare. The citizens of Oceania are constantly monitored through telescreens that display the symbolic image of the "Big Brother" – the regime's leader – and their minds are persistently manipulated by the Ministry of Truth, whose scope is to re-write history according to the directive of the party. In addition, the regime progressively introduces a new form of language, called "Newspeak", which is aimed to shorten the vocabulary so that any undesirable word will be erased. This measure is further supported by the principle of "doublethink" according to which citizens should accept two mutually contradictory beliefs to be truth if this is the wish of the ruling party. Anyone who rejects the governmental ideology or violates the imposed rules is arrested, interrogated, and tortured as form of "rehabilitation". Once the convicted has fully embraced the process of indoctrination s/he is temporarily released in the

society before vanishing without leaving any traces of his/her past existence.

This story represents a point of reference for the whole dystopian literature and cinematography. As in *Nineteen Eighty-Four* (1984), many contemporary dystopian movies are set in future societies ruled by authoritarian regimes that regularly use techniques of psychological manipulation and physical repression to preserve their power. Some of these techniques are very close to those narrated by Orwell, others have been introduced considering the historical evolution of authoritarian governments, and others again have been creatively constructed by imagining which methods of subjugation could be used in the worst-case scenarios. The objective of this chapter is, therefore, to critically compare the fundamental strategies of socio-political control adopted by fictional and real authoritarian regimes.

Techniques of psychological manipulation and information control

In dystopian movies different techniques of psychological manipulations are enforced by authoritarian governments to preserve the *status quo*. For example, the movie *Equilibrium* (2002) is set in the fictional city-state of Libria, a place governed by a dictator commonly known as “The Father”. Perceiving emotions as the real cause of wars and human cruelties, the ruling authoritarian government imposes a series of measures aimed to hinder human sentiments. First, the daily assumption of a drug that, by inhibiting emotions, also suppresses feelings of discontent and desires of change. Second, the destruction of cultural property such as, for example, books, paintings and music discs, that are viewed as

dangerous tools which may stimulate “negative” emotional reactions. Third, the institution of the *Tetragrammatum*, an organization whose members are trained to identify and arrest anyone who is found out feeling emotions. Fourth, the regular broadcast on mega-screens of propaganda messages from “The Father”. Whoever commits legal infractions is punished with a death sentence. One of the most dramatic scenes shows how Mary, a citizen of Libria who has been sentenced to death due to her possessions of illegal material, is accompanied to the furnace beneath the city and burned alive.

In *V for Vendetta* (2006) the United Kingdom is governed by Norsefire, a fascist party ruled by High Chancellor Adam Sutler. Sutler’s reign of terror is based on an almost complete suppression of human rights and liberties justified by the need to preserve order and stability. Among the restrictive measures implemented by the government there are, for example, the confiscation and destruction of any prohibited objects, which include satirical paintings, classical art and non-Catholic sacred books, as well as the implementation of a harsh system of censorship and media control. In this regard, particularly emblematic is a scene where a group of secret service agents breaks into the home of a comedian who made jokes about the High Chancellor in his famous TV programme. Despite his notoriety, the anchor is brutally beaten and, then, transported to a detention centre.

The story of *Land of the Blind* (2006) narrates the endless transition from one dictatorial government to another one where free democratic election are regularly procrastinated due to “security issues”. The various authoritarian leaders

shown in this movie have different personalities and they are moved by diverse "moral principles". Nevertheless, all of them make an extensive employment of propaganda and censorship to preserve their position of power. For instance, during the authoritarian reign of Maximilian II the government promotes movies in which the leader himself acts as the saviour of the nation. After the assassination of Maximilian II, however, the political leadership moves to his main enemy John Thorne, the former number one enemy of the state. Under John Thorne's new reign of terror action movies are completely banned.

In *The Hunger Games* film series (2012–2015) the fictional state of Panem is led by President Coriolanus Snow, an authoritarian leader who uses media control, violent repression and the ploy of the "Hunger Games" – a kind of deadly-arena-competition for randomly extracted teenagers – as tools to preserve its absolute supremacy. Interestingly, at the beginning of the first movie of the series, president Snow explains that the Hunger Games are an historical commemoration aimed to remind to everyone the suffering provoked in the past by the rebellion of the thirteen districts against their country as well as the generosity of Panem to forgive such offense. But then, in a private conversation with his assistant, he reveals that the games are used as an expedient to reach what he cannot get with the sole fear: to keep order and stability by giving to the various districts a little (but controlled) hope.

Methods of physical repression

All the movies mentioned above are also organized around a sort of police state where acts of indiscriminate detention, extreme violence and torture are systemically used by security

forces as means to preserve the authoritarian regime. In *V for Vendetta* (2006) corrupted vigilantes freely make use of violence, forced disappearance and torture against all those who are accused of having violated the law. One of the initial scenes of the movie shows how such condition of unrestrained power is immorally exploited by security forces to gain advantage of regular citizens: the veiled message is that, in such an extreme scenario, citizens would be completely deprived of their rights and freedoms without being able to invoke any institution to protect them.

In the movie *Land of the Blind* (2006), under the government of Maximillian II the systemic arrest of dissidents and the violent suppression of protests are common measures adopted by the government to cut off acts of disobedience. The death of Maximillian II, however, does not lead to a greater respect of human rights. As his predecessor, the new leader John Thorne extensively recurs to the arrest of political dissidents as well of all those who represent a "threat" for the regime (included, paradoxically, doctors whose medical activity clashes with the ideology of the government). Those arrested are then sent to re-education camps where their will is destroyed through the recurrent use of different systems of torture.

In *The Hunger Games* film series (2012–2015), President Coriolanus Snow perceives any mean necessary to maintain his leadership as legitimate. As a result, violence is firmly used to suppress any sign of riot in the districts. Likewise, methods of physical and psychological torture are strategically employed to break the resistance of those who fight the regime. For instance, in *The Hunger Games: Catching Fire*

(2013) Gale – the boyfriend of the protagonist, Katniss Everdeen – gets publicly whipped by police forces to demonstrate that insubordination cannot be tolerated, while in *The Hunger Games: Mockingjay – Part 1* (2014) President Snow condemns Peeta (the male tribute of District 12) to brainwashing so as to feel an unconditional hatred towards Katniss.

To sum up, these dystopian movies share the view of a future world system dominated by authoritarian governments whose cruel and charismatic leaders control their citizens through mechanisms of psychological manipulation and physical repression. Free thoughts are suppressed through an assorted combination of propaganda, censorship and media control. Public order is enforced by arresting, torturing and/or killing all those who commit an infringement or try to contest the legitimacy of the government.

Reality

According to Samuel Huntington (1991), in the modern history the world experienced three waves of democratization and each of them has been followed by a reverse wave that has significantly declined the number of existing democratic countries. The first wave began in 1820s and lasted till the rise of fascism in Italy in 1922. In this period of time the number of democratic countries rose to 29 and then collapsed to 12 in 1942. The second wave begun after the end of World War II and achieved its peak in 1962, with 36 democratic countries in the world. Then, it faced a declining phase in the 1960-70s when the number of democracies fell to 30. With the third democratic wave, which begun in the mid-1970s, the number

of democratic states doubled and with the collapse of USSR such democratization trend still continued for a number of years.

However, there are three good reasons to believe that democracy has now entered into a period of crisis. First, the recognition and enforcement of democratic principles in the world is living an extended declining phase. According to Freedom House (2018, 1), in 2017 political rights and civil liberties registered the worst regression in over a decade, thus establishing the 12th consecutive year of decline in global freedom.

Second, there is a relatively stable-balance in the number of democratic and non-democratic countries in the world. The Economist Intelligence Unit's 'Democracy Index 2016' (2017, 3) offers a snapshot of current political state: although almost half of the world population live in a democratic state, only 4.5% reside in a "full democracy". Moreover, one-third of people in the world still live under an authoritarian regime and an additional one-fifth live in a hybrid regime, which are political systems that combine democratic elements (like, for example, the regular call for a general election) with authoritarian ones (such as, for instance, restrictions on civil liberties and political rights).

Third, democracy is also facing harsh times in some of the most historically-rooted liberal democracies like the USA and European countries. On one side, Freedom House claims that, in the last seven years, the USA has faced a slowly, but constant decline of political rights and civil liberties. This alarming degeneration has further accelerated since 2017

(Freedom House 2018). On the other, a research conducted by Timbro reveals that 'since the period between the two world wars European voters have never been as eager to support authoritarian parties as they are today' (Heinö 2016, 21).

Although it is hard to precisely identify the root-causes of this crisis, a number of internal and external factors have presumably contributed to this reversal phase: historical circumstances (such as, for example, the 2008 world financial crisis, the US military interventions in Afghanistan and Iraq, and the massive migrations observed in different areas of the world), political processes (like, for instance, the spreading, in certain regions of the world, of illiberal democracies and electoral autocracies), socio-economic trends (as the already mentioned increasing gap between the richest and poorest people of the world), and the emergence of new systems of mass communication (such as social networking sites and blogs) (Møller and Skaaning 2013; Goldstone, McNamara and Hamid 2017; Ferguson 2018). Interestingly, as claimed by Steven Levitsky and Daniel Ziblatt (2018, 10), 'since the end of the Cold War, most democratic breakdowns have been caused not by generals and soldiers but by elected governments themselves.' Still, the final outcome is a progressive erosion of those norms and liberal principles that act as pillars of democratic institutions (Traub 2018).

The present crisis in democracy has raised a heated debate among scholars. Some authors, like Danial Deudney and John Ikenberry (2009), believe that this crisis is just a temporary phase which will not really sign the revival of autocratic governments. In their view, the recent success of authoritarian states is primarily due to their involvement in

the international liberal order. However, the liberal system entails the embracement of certain principles (e.g. a rising demand for political participation and accountability, an independent and efficient system of law, and the demand for competitive elections) that are deeply in contrast with the functioning of an authoritarian government. Such contradictions will suddenly come out, thus driving a regime change or leading to the collapse of the ruling authoritarian government.

Differently, Robert Kagan (2008) considers the ongoing crisis of democracy as a rooted process, which might provoke long-term implications. In his view, democratic countries lack a cohesive strategy aims to promote an sustain the democratic principles in the world. Such condition has favoured the resurgence of authoritarian regimes that, differently from the past, have demonstrated a certain ability to achieved economic growth, while suppressing political pluralism. As a result, the world will soon fall into a new phase characterized by growing tensions and risky confrontations between democratic and autocratic forces. The sole condition for preventing such unwelcomed scenario is that liberal democratic countries will tie together to jointly face the rising authoritarianism.

Therefore, as in dystopian movies, authoritarian regimes are a noteworthy characteristic of contemporary world society. But a major question then arises: how do authoritarian governments preserve their power? According to Johannes Gerschewski (2013), the stability of contemporary autocratic regimes is directly related to three main factors: their legitimation in front of their citizens, their capacity of

repression, and their system of co-optation, which refers to the direct involvement of citizens in the regimes' activities. Actually, contemporary authoritarian governments seem to consolidate these three strategic pillars through different means, some of which are very similar to those used in dystopian movies.

Techniques of psychological manipulation and information control

In several respects, the dystopian movies examined above seem to offer an accurate description of the current state of affairs in authoritarian countries. First of all, authoritarian governments consistently use multiple tools to limit people's freedom of information and expression. According to the 2018 World Press Freedom Index, 22 countries have a very serious problems of media freedom and other 48 face a difficult situation (Reporters Without Borders 2018). Many authoritarian regimes own the main domestic channels of information or have a strong influence over them. As a result, freedom of information is highly restrained through media controls which preventively silence protests and distort reality. In this regard, the media control shown in movies like *V for Vendetta* (2006) and *The Hunger Games* film series (2012–2015) seems pretty close to the restrictions imposed in countries like Turkmenistan, Eritrea and North Korea (the last three countries of the World Press Freedom Index).

Authoritarian governments tend to limit people's freedom of expression through a combined use of mass surveillance and censorship. For instance, a recent research reveals that stable autocracies have invested 11 times more than any other regime type for individual surveillance (Kostyuk et al. 2017,

16). Through the banning of internet sites and social networks, despotic regimes further preclude the possibility for the oppressed citizens to raise their voices. In some cases, authoritarian regimes have also adopted laws that prohibit criticisms against the government (Hem 2014, 14-21). Those who violate the law are commonly charged for anti-state acts that undermine social stability and they are often punished with several years of prison.

In the worst instances, journalists have been targeted following their inquiries and publications. According to the Committee to Protect Journalists (2018), 821 journalists were intentionally murdered in the world between 1992 and 2017. In 167 cases the attacks were directly related to government officials. The same source reveals that 2017 signed a new historical high, with a record of 262 imprisoned journalists worldwide, most of them accused of anti-state charges (Committee to Protect Journalists, 2017). The situation is further exacerbated by the fact that there is a tendency towards impunity for crimes against journalists, as many cases remain judicially unsolved (UNESCO 2018, 142-144). Again, this combination of censorship and punitive detention of dissidents mirrors fictional stories such as *Nineteen Eighty-Four* (1984) and *Land of the Blind* (2006).

Concerning the intentional destruction of cultural heritage, there are a number of cases where the ruling authoritarian governments have ordered the destruction of cultural property. Two recent examples are the Taliban destruction of the two Buddhas statues of Bamiyan (Afghanistan) in 2001 (Francioni and Lenzerini 2003) and the Serbian burning of libraries in Croatia and Bosnia between 1992 and 1995 (Knuth

2003, 117-130). However, the destruction of cultural property seems more a disgraceful circumstance associated with acts of ethnic persecutions, iconoclasm and planned/opportunistic looting, rather than a repeated strategy used by authoritarian governments to keep their power. Differently, a common practice among authoritarian regimes (and, at times, by some democratic states too) is the ban of foreign books and movies that are labelled as "indecent" or the censorship of "undesirable" artworks. After having reviewed 553 documented cases of violations of artistic freedom, Freemuse (2018, 8), an independent organization involved in the defence of artistic expression worldwide, arrived to the conclusion that 'a new global culture of silencing others is emerging.' Therefore, even in the censorship of the art there are some elements of contact between certain contemporary authoritarian governments and the ruling regimes of movies like *Equilibrium* (2002) and *V for Vendetta* (2006).

On the whole, these restrictive conditions allow authoritarian regimes to constrain any criticism against their actions and to isolate dissidents. At the same time, the authoritarian position is reinforced through an extensive use of various propaganda and disinformation techniques. The printing of posters, the organization of military parades as symbolic exhibition of power and the broadcasting of videos promoting the quality of "governmental policies" for indoctrination purposes are legacies of the past still used in some authoritarian countries. Interestingly, many contemporary authoritarian governments have shown a particular devotion toward the organization of blockbuster sporting events such as Olympics Games, Football World Cups or Formula One races. As in *The Hunger Games* movie (2012), these mega-events are hosted for a strategic

purpose: to increase public consensus and international recognition by diverting the attention from the extensive human rights' violations regularly occurring in the country to the infrastructural, technological and socio-economic advances achieved by the authoritarian government (Brady 2009; Cornelissen 2010).

Moreover, most of contemporary authoritarian governments have adapt their techniques of persuasion to the digital media era and, nowadays, propaganda is mainly used as a vehicle to show 'the government's strength in maintaining social control and political order' (Huang 2015, 421). Often public opinion is manipulated by using two mutually reinforcing strategies. First, the dissemination of "fake news" in order to discredit all those ideas that clash with the narrative of the ruling regime. Second, the employment of "post-truth" stratagems aimed at diverting public attention towards concrete and real problems. The final outcome is an alternative interpretation of facts, which intentionally creates confusion and uncertainties in order to discredit any view that contrasts with the official standpoint. In this framework, "the borders between fact and fiction have become utterly blurred" (Pomerantsev quoted in Puddington 2017, 17).

Although numerous seem the points of contact between fiction and reality in relation to the acts of psychological manipulation and information control perpetrated by authoritarian governments, it must be observed that there are also some noteworthy differences. First, contemporary authoritarian governments tend to show a manifested willingness to gain public recognition and legitimation which is mostly ignored in dystopian films. This goal is generally

achieved through the organization of fraudulent elections. In some cases, voters and members of the opposition are physically or verbally intimidated so that the authoritarian party will gain an absolute majority. In other circumstances, the result of the election is illegally manipulated in order to favour a specific candidate. According to the analysis of Beatriz Magaloni (2010, 763), 'even when their opponents are able to defeat them in elections, autocrats often resort to electoral fraud to maintain power. Under this condition, their survival simultaneously depends on whether the opposition fails to coordinate a mass revolt and on the ruler's reliance on repressive apparatus to enforce its fraud.' Thus, by regularly holding fraudulent elections, authoritarian governments can create an illusion of pluralism, while actually displaying supremacy and pride for the prearranged success (Puddington 2017, 10-14).

Second, no sovereign state has articulated a devious process of language simplification for constraining the freedom of thought as in the film *Nineteen Eighty-Four* (1984). Truly, vulgarisation (like the stigmatization of the "out-of-group" members as a threat to security and well-being) and generalization (such as a frequent reference to "the people" in opposition to "the elites") have become the common communication strategies of several populist leaders (Aalberg et al. 2017). This trend is relevant considering that, in the past, similar communicative strategies were employed for making more publicly acceptable the introduction of norms aimed to restrict freedoms and rights for certain groups. However, a structured language simplification like the "Newspeak" remains, so far, a technique confined to the fictional world of dystopian stories.

Finally, there are no officially confirmed cases of authoritarian regimes imposing the consumption of drugs to inhibit citizens' emotions and ideas. Eventually, what some authors suggest is that a brutal war on drugs could favour an authoritarian turn in a country (Lindau 2011; Santos 2019). But this circumstance has no links with the dystopian movies examined above.

Methods of physical repression

Like in dystopian movies, the identification, arrest and/or exile of political dissidents and civil protesters is a common practice of contemporary authoritarian regimes. Nevertheless, new authoritarian governments tend to use a subtler strategy- compared to the examined fictional regimes. The use of violence is, for instance, usually confined to those critical situations that might put the regime at risk. This condition is dictated by the recognition that harsh measures might reduce the legitimacy of authoritarian regimes, spread popular discontent and foster the rise of dissidents (Tanneberg, Stefe and Merkel 2013, 116). Still, based on need, political opponents are threatened, defamed, arbitrarily arrested or forced to emigrate. (Guriev and Tresman 2015)

Reports from international monitoring organs reveal that the arbitrary detention of people regarded as "inconvenient" by national authorities is still practiced in different countries of the world. From 1st January to 31st December 2018, the United Nations Working Group on Arbitrary Detention (2019) sent 75 letters of urgent appeals about 189 detained people. In such letters, they were asking to the receivers – which included both democratic and authoritarian countries – to take adequate measures aimed to ensure the respect of prisoners'

rights to life, liberty and personal integrity. In the same period of time, this organization issued 90 opinions concerning 246 people who were supposedly arbitrarily detained in 47 countries.

Overall, authoritarian regimes tend to publicly justify the use of repressive measures with the declaration of a state of emergency like, for example, a terrorist threat, the risk of secessionism or the spread of political disorder. This seems, for example, the case of Iran where, in 2018, more than 7,000 dissidents have been arrested as a response to public protests (Amnesty International 2019) and Venezuela, where more than 12,500 people have been arrested since the begging of the riots in 2014 (Human Rights Watch 2019). In other circumstances, however, violent actions are simply covered up through an extensive campaign of censorship or, alternatively, through misleading reinterpretations of the events in the main national medias (Hess and Martin 2006, 251-252).

As in dystopian movies like *V for Vendetta* (2006) and *The Hunger Games* film series (2012–2015), different despotic regimes still use the practice of torture. Gaining precise data about this phenomenon is a difficult task due to the illegal nature of such act. However, Amnesty International (2014, 10) affirms to have received reports of torture from 141 countries between January 2009 and May 2013. Curiously, according to James Hollyer and Peter Rosendorff (2011, 277), those authoritarian countries that signed the 1984 United Nations Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment, mainly did it as 'a signal to the opposition' of their willingness to use torture if this extreme measure is viewed as a necessary condition for

strengthening their position of power. This perception seems, unfortunately, confirmed by the data on torture and other ill-treatment collected by Amnesty International (2018) and Human Rights Watch (2018). The same United Nations Special Rapporteur on Torture and Other Cruel, Inhuman and Degrading Treatment or Punishment recently had to admit that, in spite of the extraordinary results achieved so far in the international protection of human rights, 'torture and ill-treatment continue to be practiced with impunity throughout the world' (Amnesty International 2018; UNGA 2018, 20).

Finally, concerning the issue of re-education camps, it is hard to gain precise data about the spread and impact of this phenomenon worldwide. Nevertheless, the opening of re-education camps for Uighur people in Xinjiang (China) caught the attention of international public opinion. Sayragul Sauytbay, a Chinese national with Kazakh ethnic origins who was forced to teach Chinese language in the re-education camps before escaping from Xinjiang, offered a detailed description of the harsh living conditions in such facilities. According to her story, the inmates are forced to learn Chinese and Communist Party propaganda songs while daily suffering from food deprivation, inhuman punishments and sexual abuses (Stavrou 2019). Even if the Chinese government has officially denied that similar mistreatments have ever taken place in such centres, many details of her story seem confirmed by other former convicts.

Final remarks

This section has portrayed a quite pessimistic political global scenario, in which democracies are facing a period of crisis,

while new authoritarian regimes are unexpectedly reasserting a place in the world. Most of the practices used by authoritarian regimes to preserve their leading position seem pretty close to the severe and frightful strategies adopted by their "fictional colleagues" of dystopian movies: media control like in *The Hunger Games* (2012), propaganda and censorship as in *Equilibrium* (2002), mass surveillance such as in *Nineteen Eighty-Four* (1984), re-education of dissidents as in *Land of the Blind* (2006), and a strategic use of torture as in *V for Vendetta* (2006). Still, the political future of the world is not necessarily so dark.

Although democracies are vulnerable to setback, they also possess various mechanisms of resilience, included: a widespread consensus over the importance of democratic principles for a state legitimacy, security and progress; a recognized capacity to solve social tensions and counter corruption; a system of multiple checks and balances that ensures the preservation of integrity-enhanced rules for political competition; various measures aimed to promote social inclusion and protect marginalized and minority groups (IDEA 2017, 36-60). Therefore, the present declining confidence towards democratic institutions might possibly be reversed by adapting them to the international system changes and by making them more efficient through innovation. However, without such interventions it is doubtful whether democratic resilience would be strong enough to withstand the impact of the raising authoritarian regimes.

Chapter 7: Weapons of Mass Destruction

Fiction

A number of dystopian movies is set in a post-apocalyptic world, where the extensive use of weapons of mass destruction turned the Earth into a desolate landscape. Many times, the conditions that caused the catastrophe are just briefly mentioned at the beginning of the movie or they are even completely omitted from the narrated story. Nevertheless, there are also movies that offer a more detailed description of the underlying causes as well as the devastating effects related to the use of weapons of mass destruction. This chapter refers to these fictional examples in order to explore the actual risks associated with nuclear, chemical and bacteriological weapons in a context of war or in case of a terrorist attack.

The threat of nuclear weapons

Most of the dystopian movies depicting a nuclear attack were released during the Cold War period when this scenario was widely perceived as a conceivable threat. Despite having been released in cinemas earlier than the other films analysed in this book, two movies from the 1960s deserve, at least, to be mentioned: *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb* (1964) and *Fail-Safe* (1964). The cinematographic masterpiece *Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb* (1964) explains how the world could involuntarily get into a nuclear holocaust. In this film, the insanity of a US general who commands a nuclear first strike against Soviet targets, a USSR doomsday automatic machine that cannot be stopped, and a series of

further unlucky events trigger an unsolicited nuclear disaster. Likewise, in *Fail-Safe* (1964) an error in the system of communication leads a group of US bombers to launch a nuclear attack against Moscow. In order to avoid a massive USSR retaliation, which would inevitably cause a global holocaust, the US President orders to his most loyal general to drop two twenty megaton bombs on the city of New York as a way to appease the Soviet leader. What makes these two movies particularly interesting is how they conceive an accidental employment of nuclear weapons – due to a combination of sabotages, malfunctioning and technical mistakes – as a concrete threat.

More recently, the *Terminator* blockbuster series (1984 – 2015) has raised again the attention towards the risk of a nuclear holocaust. An iconic-shocking scene of *Terminator 2: Judgment Day* (1991) shows the destructive phases of a nuclear bomb blasting in the centre of a mega-city: a bright flash in the sky is followed by a nuclear mushroom, an intense heat that burns all humans nearby and a shockwave that disintegrates everything it finds along its path. Differently, the last scene of *Terminator 3: Rise of the Machines* (2003) reveals from a satellite view what would happen if every single atomic weapon in the world went off at the same time. In the movie such event is called the "Judgment Day".

Three more recent disaster movies which narrate the blasting of nuclear devices are *Deterrence* (1999), *The Sum of All Fears* (2002) and *The Divide* (2012). In *Deterrence* (1999) the US President orders to drop a nuclear bomb on Baghdad in response to a new Iraqi invasion of Kuwait. In *The Sum of All Fears* (2002) a neo-Nazi group organizes the blasting of a

nuclear device in the city of Baltimore (USA) as a ploy to provoke a Third World War. In *The Divide* (2012) the source behind a nuclear attack against the United States remains unknown to the viewer, but the movie, in its opening scene, well represents on screen the moments of panic, violence and disorder that might immediately follow to a nuclear strike, while, in its closing scene, it reveals the endless devastation of a post-nuclear scenario.

A last brief-mention is for the thriller movie *Blackhat* (2015): this movie does not contain any scene about the blasting of nuclear bombs, but it shows how a hacker is able to remotely provoke the explosion of a nuclear power plant in the city of Hong Kong. Overall, these movies seem to reveal that a nuclear disaster might be the result of both random accidents as well as calculated geopolitical strategies of states or criminal groups.

The threat of bacteriological and chemical weapons

Other movies associate the formation of post-apocalyptic contexts to the extensive use of biological weapons. Interestingly, the release of a highly deadly bacteriological pathogen is related to diverse circumstances. In *12 Monkeys* (1995) a terrorist attack is at the origin of a viral outbreak that decimates humanity and forces the survivors to live in underground facilities. The whole movie seems to suggest that the only way to counter such a bacteriological epidemic would be to prevent it. In *Resident Evil* (2002) the intentional release of a genetically engineered virus during a failed attempt to steal some samples from a secret laboratory will trigger an out-of-control zombie pandemic. As in the previous case, this film also stresses the complexity to contain the virus once the

epidemic begins. In *V for Vendetta* (2006) a rising fascist-party orchestrates the release of a deadly virus in order to convince the civilian population that only a firm and resolute government could restore a systemic order. In *The Crazies* (2010) the fall into a river of a military aircraft transporting a biological weapon called "Trixie" contaminates drinking water supplies, thus turning the citizens of Ogden Marsh into irrationally violent people.

Likewise, the use of chemical weapons follows different patterns. In the most recent version of *Total Recall* (2012) a chemical war transforms most of Earth's lands into an unliveable environment. In the animated movie *9* (2009), a toxic gas released in the atmosphere by a self-governing machine called "B.R.A.I.N." provokes the complete extinction of the humankind. In *Air* (2015) the dispersion of volatile toxic substances forces the last human beings to hide in underground facilities and enter a state of cryogenic sleep in the hope that someday the conditions on the planet will be restored to support human life. Finally, in *Batman Begins* (2005) a terrorist organization known as the "League of Shadows" attempts to disperse a neurotoxin gas in order to provoke the collapse of Gotham city.

To sum up, these movies seem to share three main concerns. First, the risk that weapons of mass destruction might be intentionally used by states, terrorist organizations or other groups is concrete. Second, a series of "unlucky events" could also lead to an accidental employment of these weapons. Third, regardless the causes of the event, if activated, these weapons can provoke massive human casualties as well as devastating environmental effects.

Reality

A nuclear weapon is a 'device designed to release energy in an explosive manner as a result of a nuclear fission, nuclear fusion, or a combination of the two processes' (Encyclopaedia Britannica 2019). In the last decade, discussions on the nuclear risk have got the spotlight in response to events like, for example, the tensions over North Korean nuclear tests and the US concerns over the efficacy of the Iranian nuclear deal.

Since the end of the 1980s the total number of nuclear warheads in the world has significantly declined, mainly as effect of the arms reduction treaties signed by the USA and USSR as well as the Nuclear Non-proliferation Treaty in 1970 (UNODA 1968). Nevertheless, nowadays there are still approximately 15,395 nuclear weapons in the world (Kile and Kristensen 2016, 1). The USA and Russia, which respectively possess 7,000 and 7,290 nuclear warheads, account together for 93% of the global nuclear arsenal. The remaining 7% cumulatively belongs to People's Republic of China (260), the United Kingdom (215), France (300), India (100-120), Pakistan (110-130), Israel (80) and North Korea (10) (Ivi, 2).

The power of these weapons has also sharply increased since the development of hydrogen bombs (1950s). While atomic bombs are fission devices, hydrogen bombs exploit the energy produced by a fusion reaction, thus producing a higher amount of energy. For instance, the "Little Boy" nuclear bomb used in 1945 at Hiroshima had a power of 15 kilotons (1 kiloton is an explosive force equal to 1,000 tons of TNT), while, the "Tsar bomb" detonated by the USSR in 1961 had a power

of around 50-60 megatons (1 megaton is an explosive force equal to 1,000,000 tons of TNT or 1,000 kilotons). As a result, the “Tsar bomb” was almost 3,800 times more powerful than the “Little Boy”. When tested, the “Tsar bomb” completely destroyed an area of over 25 kilometres and, as effect of atmospheric focusing, buildings located hundreds of kilometres from ground zero also suffered significant damages (nuclearweaponarchive.org 2007). Beyond their immense destructive power, the blasting of nuclear warheads would also cause a nuclear fallout – the widespread of radioactive dust in the atmosphere and its successive fall on the ground– that would conceivably provoke cellular degradation and DNA damages to all those people who are exposed to it.

Differently, biological weapons can be generally defined as arms, equipment or means designed to use bacteriological agents or toxins for hostile purposes. These weapons can be organized in different typologies according, for example, to the used agent (e.g. bacteria, virus or toxin), the mode of transmission (e.g. aerial or through direct exposition), and the produced symptoms (e.g. deaths, organs malfunctioning or others) (Blix et al. 2006, 113). Pre-estimating the impact of these weapons on societies is a complex practice. The effects might be different according to the nature of the pathogen, the mechanism of dissemination and the features of the surrounding environment. Anyway, a report of the World Health Organization (1970, 74-75) reveals, for example, that ‘if an initial infection with pneumonic plague were to involve about 50% of a population, it is likely that, unless precautions had been taken, up to about 90% of the rest of the population would be infected in 20-30 days, with a case fatality rate of

60-70%.' Therefore, these weapons might potentially have devastating effects in terms of human casualties.

As for chemical weapons, they are arms and devices that make use of toxic chemicals in order to cause death, temporary incapacitation or permanent harm. The Annex to the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction provides specific schedules of the identified toxic chemicals and their precursors (UNODA 1993). Simplifying, there are four main types of chemical weapons: first, there are blistering agents (like sulphur and nitrogen mustards), that can provoke severe chemical burns on those who are affected; second, there are nerve agents (such as sarin and VX) that can disrupt the functioning of the nervous system causing asphyxiation or cardiac arrest; third, there are blood agents (as cyanide or arsenic) that can poison body cells causing death; and, fourth, there are choking agents (e.g. chlorine and phosgene) that can provoke suffocation (Nehme 2018). Overall, chemical weapons have more limited and confined effects compared to nuclear or biological weapons. Still, these weapons can provoke such horrible effects on the human body to cause a remarkable fear effect in the whole population. As a result, they have been deliberately used as military and terrorist tools for disseminating fear and terror among the enemies (Szinic 2005).

This chapter aims to explore deeper the threat represented by these weapons by considering some historical case studies as well as recent hazardous episodes.

The threat of nuclear weapons

Historically, nuclear weapons have been operatively used in warfare only two times: on 6 and 9 August 1945, when US forces dropped two nuclear weapons on the Japanese cities of Hiroshima and Nagasaki. In these events, the estimated number of total casualties ranged from 100,000 to 200,000 people (Avalon Project, n.d.; United States Strategic Bombing Survey 1946, 15). Since then, the system of deterrence – the idea that to a country's first nuclear strike would have followed a retaliatory nuclear attack by the affected country, with the result of devastating effects for both the contenders – prevented the further use of these weapons for offensive purposes. However, as stated by Stephen Cimbala (2010, 3): 'Nuclear deterrence is an acceptable compromise, but not necessarily a permanent feature, of the international state system.' In other terms, the past success of deterrence strategies does not necessarily imply likewise results in the future.

Moreover, in multiple past circumstances the world got quite close to a nuclear holocaust. Sometimes this happened due to the rise of political tensions. For example, in October 1962 the construction of missile installations in Cuba provoked such an escalating crisis between the USA and the USSR that, for thirteen days, the whole world feared the beginning of a nuclear war (George 2003). The tension was so high that, during one of the ExComm meetings hold in those weeks, the US President John F. Kennedy stated: 'Now the question *really* is what action we take which *lessens* the chance of a nuclear exchange, which obviously is the final failure' (Stern 2005, 54). Interestingly, the US were unaware that Soviet tactical nuclear missiles had already been transported to Cuba (Mikoyan

2012). In the end, only a gruelling negotiation between Kennedy and Khrushchev finally allowed to reach a compromise agreement that reduced the tensions and undermined the risk of a nuclear confrontation. According to Sergei Khrushchev (2002, n.d.), in that occasion 'the world was lucky. Neither President Kennedy nor Father [Nikita Khrushchev] stumbled. They resolved not to act rashly.' A further crisis between the USA and the USSR took place in November 1983. In a context of soaring tensions between the USA and the USSR, a NATO military training called Abel Archer 83 was mistakenly interpreted by Moscow as a masked first-strike attack. Soviet nuclear forces were placed on high alert and only the decision of US Lieutenant General Leonard Perroots to not counter-react avoided a risky escalation of the events. In the view of Taylor Downing (2018, 344) 'all sides had reason to be embarrassed by the events of November 1983. The Soviets nearly launched a nuclear war as a consequence of their paranoia and miscalculation. NATO played out a highly provocative war game without realising that it nearly sparked a devastating nuclear exchange.'

In other cases, false alarms due to technical mistakes or banal misunderstandings brought the world on the verge of a nuclear apocalypse. On 9 November 1979 an operational computer of the North American Aerospace Defense Command (NORAD) signalled a massive nuclear Soviet attack against the United Stated, but the radars did not confirm the attack. It was later discovered that someone inadvertently launched a simulation scenario that generated the false alarm (Schlosser 2013, 361-387). On 26 September 1983, a USSR satellite early warning-system reported the launch of 5 nuclear missiles from a US military base. The official in charge

– Lieutenant Colonel Stanislav E. Petrov – correctly suspected a malfunctioning of the system considering that a US nuclear offensive would have plausibly implied the use of a higher number of missiles. His wisdom prevented the risk of a nuclear war (Schlosser 2013, 433-459). On January 25 1995, Russian President Boris Yeltsin activated the nuclear briefcase after a rocket was launched from Norway. It turned out to be a Norwegian scientific rocket aimed to study northern lights (Forden 2001).

Overall, the premises of these historical examples highly resemble the fictional narratives mentioned at the beginning of this chapter. Fortunately, the final outcome has been different and a nuclear war has been prevented to date. These cases should, nevertheless, warn us about the concrete possibility that these powerful weapons might be used one day as a result of strategic choices or banal miscalculations. This day could actually be closer than commonly expected. In 1947 the Bulletin of Atomic Scientists created the Doomsday Clock: a symbolic indicator of the world's proximity to a catastrophic event, symbolically represented by the midnight hour. Every year the "time" is re-set by a group of experts on the basis of the events that took place the previous year. According to their last report, the world is 'now two minutes to midnight–the closest the Clock has ever been to Doomsday, and as close as it was in 1953, at the height of the Cold War' (Mecklin 2018, 3).

Although states are currently the only actors controlling nuclear devices, hackers and terrorists are also a potential source of threat. In 1997, the United States President's Commission on Critical Infrastructure Protection made the

following statement: 'While the possibility of chemical, biological, and even nuclear weapons falling into the hands of terrorists adds a new and frightening dimension to physical attacks, such weapons are difficult to acquire. In contrast, the resources necessary to conduct a cyber-attack have shifted in the past few years from the arcane to the common place. A personal computer and a telephone connection to an Internet Service Provider anywhere in the world are enough to cause harm' (USPCCIP, 1997, p. x). So, the key question is: can the systems managing nuclear missiles potentially be hacked? According to a 2018 report of the think tank Chatham House, the answer is yes. The authors of this report claim that 'the likelihood of attempted cyberattacks on nuclear weapons systems is relatively high and increasing from advanced persistent threats from states and non-state groups… Recent cases of cyberattacks indicate that nuclear weapons systems could also be subject to interference, hacking, and sabotage through the use of malware or viruses, which could infect digital components of a system at any time' (Unal and Lewis 2018, 3-4).

Concerning the risk that a terrorist organization will, one day, get access to a nuclear weapon, this is commonly considered as the "worst case-scenario" because any kind of retaliatory threat would lose its power of deterrence against an actor whose geographical position is unknown. Fortunately, the stealing or construction of a nuclear device by a non-state actor are horrific, but remote eventualities. On one side, systems of high security control protect nuclear silos from possible thieves. On the other, the scientific know-how and the highly advanced technical equipment required for the production of plutonium or highly enriched uranium make the

construction of a nuclear bomb complex for a non-state actor. However, a terrorist group might attempt to craft a dirty-bomb. A dirty-bomb is a conventional bomb that would also disperse radioactive material at the act of blasting (Blix et al. 2006, 84). Terrorist groups might possibly steal dangerous radiological material from hospitals, research labs, nuclear power plants or other industries. It seems likely that the immediate impact of these bombs would be high in the widespread of panic, but relatively contained in the number of victims. However, there would be significant direct economic costs, related to the containment of the radiological contamination and then the decontamination of the affected area, as well as considerable indirect socio-economic effects associated, for example, with the suspension of economic activities in the zone and common concerns over long-term health effects (Ring 2004; Rosoff and Winterfeldt 2007).

The threat of bacteriological and chemical weapons

Accurately assessing the threat of biological and chemical weapons is a complex task because the lack of authoritative information makes difficult to determine their precise stockpiles, dislocation and typology. The Arms Control Association (2018) and the 2008 CRS Report for Congress on Nuclear, Biological and Chemical Weapons and Missiles (Kerr 2008) provide valuable data on those states that might currently possess or have once possessed biological and/or chemical weapons. Overall, these two documents seem to share two concerns: first, biological and chemical weapons are a serious threat for the world; second, like in the film *Resident Evil* (2002), there are still different laboratories around the world which are plausibly working on the development of this sort of armaments.

There are a number of historical events where bacteriological agents have been exploited as tools of warfare. For instance, on the base of an historical document written by Gabriele De' Mussi, Mark Wheelis (2002, 971) claims that during the siege of Caffa (now Feodosia, Crimea) in 1346 Tartars used catapulted cadavers of plague infected people in the attempt to provoke the outbreak of an epidemic within the city. Smallpox was intentionally used by European colonizers to kill the Native American populations by providing them infected blankets (Barras and Greub 2014, 499). During World War II, Japanese soldiers tested different bacteriological pathogens against war prisoners and they released various bacteriological agents on the field to break the Chinese resistance in Changteh (Harris 1994).

After the adoption of the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction (UNODA 1972) there have been only a few alleged cases of bacteriological weapons intentionally used by states for offensive purposes (Roffey, Tegnell and Elgh 2002, 451-453). Nevertheless, different researchers have expressed some doubts over the efficacy of the mechanisms of control used by the international community to constrain states' bacteriological research programmes for military purposes (Sims 2015; Jeremias 2015; Hunger 2015). Moreover, a new fear has progressively emerged: the threat of a bioterrorist attack.

These factors allow those who use them to inculcate fear and cause confusion among their victims and to escape

undetected.' At least three cases of tentative bio-terrorist attacks deserved to be mentioned here. In 1984, members of the Rajneesh cult contaminated salads served in different restaurants of Oregon (USA) with *Salmonella typhimurium* (Carus 2000). In the mid-1990s, the Japanese sect Aum Shinrikyo conducted an unsuccessful bioterrorist attack trying to disperse a strain of *Bacillus Anthracis* from the roof of a building in Tokyo (Rosenau 2001; Takahashi et al. 2004). In autumn 2001, 22 people in the US were infected through letters containing anthrax and five of them successively died (Roffey et al. 2002, 524-525).

For terrorist organizations biological weapons might be appealing tools of death because, as affirmed by Stefan Riedel (2004, 405), 'biological weapons are unique in their invisibility and their delayed effects. For states, bio-terrorist attacks are a major threat due to the complex applicability of preventive measures. 'Since biological weapons can be disseminated by means of air, food or water and it is not possible to predict where, when and with what a bioterrorist might strike, full protection is not possible to achieve' (Blix et al. 2006, 120).

Fortunately, there are still some substantial barriers constraining the development of bioterrorism (Whittaker 2004, 117-122). First, the cultivation of bacteriological agents and toxins is a complex process that requires a skilled know-how and advanced research infrastructures. Second, the storage and transport of these weapons is risky and their concrete efficacy is indeterminate because, as mentioned above, multiple factors might intervene in the process of dissemination of the pathogen. Third, the release of a virus that indiscriminately kills all members of a society would be

severely condemn by the whole international community. Therefore, the 'threat of bioterrorism is real and significant; it is neither in the realm of science fiction nor confined to our nation' (Riedel 2004, 400). Nevertheless, the production of mass-casualty biological weapons by terrorist groups is by far more difficult to carry out in comparison to the prospective of dystopian movies such as *12 Monkeys* (1995).

Concerning chemical weapons, it is unlikely that even a massive use of chemical weapons might nowadays produce long-term global consequences as shown in dystopian movies like *9* (2009) or *Air* (2015). Nevertheless, these are dangerous weapons that have already been employed in the past for military and terrorist purposes. During World War I, for example, different chemical agents were used as weapons of mass destruction. As reported by Jonathan B. Tucker (2010, 4), 'By the end of the war, attacks with chlorine, phosgene, mustard gas, and other toxic agents had inflicted roughly one million casualties, about 90,000 of them fatal.' Successively, chemical weapons have been offensively employed in other conflicts including, for example, the Yemen Civil War (1963-1967) and the Iran-Iraq War (1980-1988) (Terrill 1991). Moreover, in 1995, members of Aum Shinrikyo conducted 'the most conspicuous chemical terrorist attack', when they released sarin gas in the Tokyo subway during rush hours (Coleman 2005, 135). The toxic gas killed 12 people and caused injuries to more than 1000 passengers.

With the entry into force, in 1997, of the so called 'Chemical Weapons Convention' important results have been achieved in restricting the development, production, and stockpiling of chemical weapons. At the Twenty-Second session of the

Conference of the States Parties to the Chemical Weapons Convention, the representatives of the International Committee of the Red Cross (2017) claimed that '95% of all declared chemical weapons stockpiles have been destroyed.' However, they also recognized that 2017 was 'the fifth consecutive year in which chemical weapons have been used, including sarin nerve agent, mustard gas, and chlorine.' In particular, different organizations have alleged the use of chemical weapons in the course of the Syrian conflict (2011 – to date).

According to Human Rights Watch (2017), the Syrian government has used chlorine and nerve agents against the civilian population in more than one occasion. This position is consistent with the outcomes of similar studies conducted by the Syrian American Medical Society (2016, 9), which reports a total of 161 chemical attacks since the beginning of the conflict in Syria. In its fourth report to the UN Security Council the Organisation for the Prohibition of Chemical Weapons (OPCW)-United Nations Joint Investigation Mechanism (2016) decreed that it had sufficient information to determine that the Syrian Arab Armed Forces were responsible for three attacks using toxic substances and the Islamic State of Iraq and the Levant (ISIL) was responsible for a fourth attack using sulphur mustard. In the seventh report, the same organization claimed that ISIS used sulphur mustard in a chemical attack conducted on 15 September 2016 at Umm Hawsh and that the Syrian Arab Republic was responsible for the chemical aerial (sarin) bomb at Khan Shaykhun on 4 April 2017 (UN 2017).

Therefore, even if dystopian movies have probably overestimated the impact of chemical weapons in a state of

war or in the framework of a terrorist attack, their concerns about a prospective growing use of these armaments seem grounded.

It appears that the more limited deadly impact of chemical weapons has, actually, contributed to their greater use in warfare zones. Moreover, chemical weapons are a dangerous threat because they result more accessible to terrorist organizations compared to nuclear or bacteriological weapons: the material is available in the market for a relatively cheap price, they do not require particularly advanced facilities or technical skills in order to be manufactured, and their transportation is relatively simple (Coleman 2005, 140; Whittaker 2004, 116-117). As a result, 'the international community should take the Syrian and related chemical crisis as a wakeup call to renew its national defences against chemical weapons' (Weitz 2013).

Final remarks

As stayed by Pope Francis (2017) 'International relations cannot be held captive to military force, mutual intimidation, and the parading of stockpiles arms. Weapons of mass destruction, particularly nuclear weapons, create nothing but a false sense of security.' The historical cases mentioned above show that the risk of a nuclear holocaust is not only a fictional narrative, but a real and concrete eventuality. Even if deterrence and cautious political calculations have prevented a nuclear disaster, there are no certainties that these strategies will be always efficient. As a result, the respect of the international agreements aimed to constrain nuclear proliferation and reduce the existing nuclear stockpile is a core condition for decreasing the chances of a global catastrophe.

Unfortunately, US President Trump's recent threat to abandon the 1987 Intermediate-range Nuclear Forces (INF) treaty reveals a rising tension between US and Russia over the nuclear arms control. (Borger and Pengelly 2018)

As shown by multiple historical cases, the disruptive potential of biological weapons is unpredictable. Allegedly, bacteriological weapons could cause an extensive epidemic that would put at risk a countless number of lives. Technically, however, the development and efficacious employment of this kind of weapons is more difficult than shown in dystopian movies. Anyway, mitigating the effects of a bioterrorist attack could be costly both from an economic point of view as well as in terms of human lives. Therefore, the mechanisms aimed to prevent the development of bacteriological weapons need to be reinforced and the international community should put diplomatic pressure to convince all states to ratify and implement the 1972 Biological Weapons Convention.

In perspective, chemical weapons have a more spatially constrained effect compared to nuclear and bacteriological weapons. Hardly they might represent an existential risk as shown in dystopian movies. Even so, these weapons are a serious threat considering that they are the easiest ones to be assembled and used in military operations or terrorist acts. Despite the good results achieved with the 1993 Chemical Weapons Convention the reiterated use of chemical weapons in the last five years clearly reveals that much still needs to be done, starting with a unanimous and absolute denunciation against their use, by any actor and in whatever context, as a serious violation of international humanitarian law.

Chapter 8: Artificial Intelligence

Fiction

A common feature of many science fiction and dystopian movies is to imagine a future world where advanced systems of artificial intelligence (AI) will introduce new opportunities and challenges for humanity. At times, the use of AI technology remains constrained to a few devices which operate under the strict control of humans. As a result, it introduces only marginal changes in society. In other circumstances, however, it establishes a new relation between men and machines that might even put at risk the survival of mankind. From a narrative point of view, the contemporary doubts over a future world dominated by AI technologies have been depicted through multiple ploys. Here the attention is exclusively focused on two of them: the rise of killer-robots and the threat of uncontrolled AI systems.

Killer-robots

The idea that autonomous killer-robots might, one day, cause panic, death and destruction is a quite recurrent theme in dystopian movies. *The Terminator* (1984) was the film that made this story line popular. This movie tells about a cyborg sent from the future to the year 1984 with the specific goal of killing Sarah Connor, the mother of the future leader of human resistance against machines. In the attempt to successfully complete its mission, the Terminator eliminates whoever tries to stop it. An interesting aspect of the movie are the first-person scenes which show how the Terminator see the world: a monochromatic vision supported by multiple code-data. The machine and human differences in perceiving

the surrounding environment mirror the divergences in assessing what it is morally right: for the Terminator completing its mission at whatever cost is the only issue that matter.

Since the release of *The Terminator* (1984), different other movies have included autonomous killer-robots in their plots. Some examples are M.A.R.K. 13 in the movie *Hardware* (1990), the "Warbeast" in *Death Machine* (1994), and the ABC Warrior of *Judge Dredd* (1995). Briefly, what these movies share is the brutality of these weapons in the fulfilment of their nefarious goal (the killing of human beings) and the extreme difficulty to halt them. So, the basic idea is that these machines are as much efficient as dangerous.

Different movies tend also to emphasize how the production and development of autonomous killer-robots might degenerate into unexpected scenarios. For instance, in the movie *Screamers* (1995), self-replicating AI weapons are intentionally created by the "Alliance" to win a war. However, through an unexpected process of evolution, these machines update themselves and begin to attack their own creators too. The movie *X-Men: Days of a Future Past* (2014) narrates how the mass production of unstoppable autonomous military robots, called Sentinels, leads to a total carnage of both mutants and human beings. In *Kill Command* (2016), the drones of a military training island are reprogrammed by an advanced AI device to use lethal force as a way to maximize training effects. As a result, the military unit sent to the site will be almost completely slain.

Therefore, these movies offer a threatening framework over the development of AI robots for offensive purposes. Once activated, killer-robots might be dangerous both in the way they are programmed to achieve their objectives as well as a result of unpredictable circumstances.

Uncontrolled AI systems

Different dystopian movies present a very pessimistic scenario over the development of advanced AI systems with the power to control complex facilities like, for example, research laboratories, nuclear military bases and spaceships. Overall, two major threats are identified in these movies. First, the risk that an AI might accidentally put at risk human society while performing its programmed functions. Second, the risk that an advanced system of AI might intentionally challenge human beings once gained consciousness of its power and abilities.

The movie *War Games* (1983) prospects the risk of a nuclear war caused by the fallacy of a computer program. In this film a young teenager begins a computer game simulation called "Global Thermonuclear War" being unaware that his opponent is actually the super computer "WOPR", which is in charge of the US nuclear missiles launchers. The risk of an automatic massive nuclear attack against the USSR is eluded only when, being forced to play multiple tic tac toe games against itself, the super computer finally realizes that the only winning move in a nuclear war game is not to play.

Even more threatening is the behaviour of the "Red Queen", an out of control AI firstly introduced in *Resident Evil* (2002) and successively re-called in other films of the series. In the mentioned movie, as a response to the release of a virus in a

top-secret underground facility for genetic research, the “Red Queen” locks the structure and kills all those who were inside for preventing a viral outbreak. When a special force is sent to investigate what happened, the “Red Queen” continues to enforce her extreme solution, attempting to kill them with a series of pitfalls and traps in order to successfully fulfil its mission.

The movie *I, Robot* (2004) is set in the year 2035, when humanoid robots called “NS-5” serve humanity in multiple daily activities. Suddenly, the robots put in act a coup d’état being guided by an artificial intelligence called “VIKI” (Virtual Interactive Kinetic Intelligence). Behind this plan there is VIKI’s perception that the human race is self-annihilating. Therefore, in an attempt to accomplish the first Law of Robotic (‘A robot may not injure a human being or, through inaction, allow a human being to come to harm’), VIKI concludes that the only way to protect human beings is to limit their freedom through a dictatorship ruled by robots.

Following the example of Stanley Kubrick’s blockbuster film *2001: A Space Odyssey* (1968), the animated movie *Wall-E* (2008) shows how a super computer (called “AUTO”), which has been created for assisting the last human survivors aboard a spaceship, autonomously takes control over the space craft against the will of its captain and passengers. In this circumstance, the objective of AUTO is to preserve its guiding role by destroying any proof that the Earth can be inhabited again.

In the already mentioned *Terminator* series (1984 - 2019) a secret military program at the US Cyber Research System

leads to the creation of a self-aware software called “Skynet”). Once an anomalous computer virus spread in the world provoking severe malfunctioning, Skynet is activated to solve the problem. However, this advanced AI technology will turn against humans, causing a nuclear holocaust (“the Judgement Day”) and hunting with killer-robots all the survivors. A similar scenario is also offered by the animated movie *9* (2009), where a self-governing machine called “B.R.A.I.N.” build an army of evil robots that will exterminate mankind through the dispersion of toxic gas in the atmosphere. The third movie of the series, *Terminator 3: Rise of the Machines* (2003), reveals an important detail: once activated, Skynet could not be stopped anymore, having become a part of the cyberspace.

But the climax of uncontrolled AI is probably reached with the movie series *The Matrix* (1999 - 2003). As a result of a war between humans and unrestrained intelligent machines, most of human beings have been unconsciously enslaved in the “Matrix”: a computer simulated-world which is aimed to keep people under control while exploiting the bio-electricity produced by their bodies as a source of energy. While the Matrix simulates the world as it was in the late 20th century, the real world is a dark and desolated place under the complete control of machines. The last free-humans are forced to live a harsh life in a hidden city (“Zion”) that is located near the core of the Earth. They are constantly hunted by sentient programmes, called “agents”, when they are connected to the Matrix in the attempt to reveal the truth to humanity as well as by autonomous killer-robots, called “sentinels”, when they try to survive in the real world.

On the whole, the central idea of these dystopian movies is that the development of advanced AI systems might be extremely dangerous due to their cold logic which prioritizes the accomplishment of their goals at the expense of anything else. Moreover, these movies assume that an advanced AI system might unexpectedly gain consciousness and, in virtue of its capacities, turn into an existential threat for humanity.

Reality

Despite the noteworthy results achieved in the AI research field in the last decades, the future scenarios proposed in the above-mentioned dystopian movies are, at the moment, pure science fiction. Nevertheless, the constant progress in AI technologies is already raising up multiple ethical dilemmas and security concerns. This section examines two of the most debated issues: first, the risks associated with the development of autonomous weapons and, second, the reservations over the possibility to keep an advanced AI system under (human) control.

Killer-robots

In general terms, autonomous weapons are armaments that have been design to automatically perform a different set of functions like, for example, mobility, navigation, targeting and/or trigger. Within this category of armaments there are lethal fully-autonomous weapons, which are 'systems that, once activated, can select and engage targets without further human intervention' (UNGA 2013, 1).

At present, the military sector still employs only few fully autonomous weapons systems and they are mainly used for

defensive purposes (Boulanin and Verbuggen 2017). Some examples are air defence systems like the GoalKeper (Netherlands), the Phalanx (USA) and the Iron Dome (Israel) which can autonomously detect, track and engage incoming offensive targets without human intervention. However, the situation might change in the next future considering that 'the limiting factor is not the technology but rather the political will to develop or admit to having such politically sensitive technology, which would allow lethal machines to operate without being under the direct control of humans' (Dyndal, Bernsten and Redse-Johansen 2017). Therefore, the perspective that this kind of weapons might soon be employed for offensive military purposes is something more than a dystopian narrative. This would open a Pandora's box: although these weapons will not presumably change the fundamental nature of warfare ('war will remain an extension of politics, a fundamentally human endeavour brought on by fear, honour, and interest'), they will plausibly 'change the manner in which war is waged' (Lovelace 2016, 1).

As a result, in 2015 a group of robotics and AI experts such as, for example, Stephen Hawking, Elon Musk and Steve Wozniak, signed a joint letter where they demanded the international banning of autonomous weapons (Pash 2015). This request has been accompanied by various informative campaigns aimed to push for an international ban of lethal autonomous weapons (see, for example, the web-site autonomouswepaons.org or stopkillerrobots.org). Particularly interesting in this regard is a short movie – *Slaughterbots* (2017) – which has been released on Youtube with the aim of raising public awareness on this issue. This movie provocatively shows how miniaturized autonomous drones

might be employed for eliminating specific target of people through the acquisition of few simple data. As a result of such attacks chaos and paranoia would spread uncontrolled.

Anyway, different opinions have been expressed on this matter (Boulanin and Verbuggen 2017; Leveringhaus 2016). Some militaries supported the idea to employ autonomous weapons in the battlefield. If used intelligently, these weapons might safeguard many lives, for example, by removing soldiers from hot combat zones or safeguarding civilians from accidental shootings and other war atrocities (e.g. mass raping). In addition, they might significantly increase the chance of success of military operations thanks to their capacity to augment and extend fighting capabilities (Clapper Jr. et al. 2007).

Still, the exploitation of these machines might also produce several undesirable effects. First, these machines would reduce the costs of war by replacing human troops. This practice might potentially make more appealing the use of hard power as a solution for international disputes. Second, in the absence of a direct human control, these weapons will autonomously decide about targeting and killing of human beings without considering the broader context. In the book *Army of None. Autonomous Weapons and the Future of War*, Paul Scharre (2018) refers to a situation he personally faced during a mission in Afghanistan, where a young girl was spotting the position of his rifle team for the Talibans. Acting in such way, she legally lost her status of civilian, but none in Scharre's team (fortunately) thought to shoot her, sharing the perception that a similar action would be wrong. Here, a core question arises: 'Would a robot know when it is lawful to kill,

but wrong? (Scharre 2018, 8-9). This question raises serious legal concerns over the effective respect of international humanitarian law by autonomous weapons as well as complex ethical dilemmas on giving decision-making power over life-and-death to machines. Third, there is a problem of legal accountability for the performed actions. In other terms, who will be legally responsible in case of "mistakes"? As claimed by Barbara Rosen Jacobson (2017, 4), 'This responsibility and accountability cannot be transferred to a machine.' Considering it a highly sensitive issue, the high contracting parties to the Convention on Certain Conventional Weapons (UN 1980) created, in 2016, a Group of Governmental Experts on Lethal Autonomous Weapons Systems (LAWS) with the specific objective to examine deeper the side effects of lethal autonomous weapons (UNOG, n.d.).

Concluding, with due distinctions, the basic idea of killer-robots, as introduced in *The Terminator* (1984) and further refined in other movies like *Kill Command* (2016), seems quite close to the concept of lethal fully-autonomous weapons. Beyond the aesthetic-structural differences (implausibly future killer-robots will possess human body features), the main divergence resides in how much "control" human beings maintain over the actions performed by these weapons. But this is, actually, the most heated debate issue in contemporary society. In the view of Heather Roff and Richard Moyes (2016, 6), 'the positioning of definitional boundaries and determinations of what form or extent of human control is considered sufficient or necessary will represent political choices […] However, developing the basic framework against which such assessments might be made is essential to such subsequent processes of analysis.' Still, the development of

shared normative patterns is going to be a long and complex process considering the different typologies as well as the multiple operational uses of autonomous weapons. (Leveringhaus 2016, 123). Furthermore, it is still unclear how much the main arms manufacturers' countries in the world are willing to cooperate on this issue. Therefore, it is likely that the discussions over the use or ban of autonomous weapons are just at the beginning.

Uncontrolled AI systems

The research and development of Self-Learning Artificial Intelligence technology is progressively becoming a topic of heated debate. In 2016, Michael Copeland wrote in the Nvidia blog-page that 'AI is the present and the future. With Deep Learning's help, AI may even get to that science fiction state we've so long imagined' (Copeland 2016). The forthcoming AI revolution is expected to introduce drastic changes in the life of many people (Makridakis 2017). Someone, however, wonders what may be the risks related to such transformation: in a famous lecture at the University of Cambridge, physicist Stephen Hawking provocatively stated that artificial intelligence will be 'either the best, or the worst thing, ever to happen to humanity' (Hawking reported in Macdonald 2016).

In simple terms, a Self-Learning Artificial Intelligence is a system that, after its initial setting, is able to automatically make decisions as well as to change its own models and parameters of analysis on the basis of the processed data, without needing any further human intervention. This outcome has been made possible through the development of deep learning: 'essentially a statistical technique for classifying

patterns, based on sample data, using neural networks with multiple layers' (Marcus 2018). An example of Self-Learning AI is Google DeepMind's Alpha Zero that, using a mechanism of reinforcement learning – repeatedly playing against itself – was able to outperform top humans and programs in multiple games like Go, Chess and Shogi. The final objective of its developers is to create algorithms that might autonomously realize superhuman performances (DeepMind blog n.d.).

Despite such remarkable results, contemporary AI systems are still limited in their capacity. As stated by Sean Lannan (2018, n.d.): 'Machines excel at the sort of abstract, cognitive tasks… But they struggle with physical jobs [like assembling an IKEA chair].' Moreover, current AI technologies are basically structured to get knowledge over a certain domain characterized by specific patterns and large amount of available data, while they face some difficulties in managing completely new and highly volatile situations (Pontin 2018). However, AI industry experts like Ray Kurzweil, Patrick Winston and Jürgen Schmidhuber believe that the singularity – the creation of an AI super-human intelligence with the ability to self-upgrading itself – will plausibly happen in the next 30 years (Creighton 2018). Therefore, there are already some ethical and practical questions over the future of AI technologies that are causing turmoil within the scientific community.

One of the main concerns is centred on the effective human capacity to keep highly-advanced AI technologies under control once they will become fully operative. The core factor that alarms scientists is that 'deep-learning programs do their learning by rearranging their digital innards in response to

patterns they spot in the data they are digesting […] This means that even the designer of a neural network cannot know, once the network has been trained, exactly how it is doing what it does' (The Economist 2018).

The scientific community has manifested diverse reactions to such potential threat. Some experts are examining in depth the potential risks associated with an unintended and harmful behaviour from AI systems (Amodei et al. 2016). Others are trying to create a system that will allow researchers to better understand the automatic decisions and actions taken by AI technologies (Gunning, n.d.). Specialists like Laurent Orseau and Stuart Armstrong (2016) are exploring the difficulties to create a "big red button" aimed to stop a learning agent from 'continuing a harmful sequence of actions.'

Recently, Nick Bostrom (2017, 135) offered a comprehensive set of opportunities and challenges related to openness in AI development, here meant as 'the practice of realising into the public domain (continuously and as promptly as it practicable) all relevant source code and platforms and publishing freely about algorithms and scientific insights and ideas gained in the course of the research.' Interestingly, in the short and medium-term an increased openness in AI might provide a positive impact by accelerating the advancements in the field and spreading the economic benefits. However, in the long-term this approach might lead to undesirable effects by favouring the development of non-safety work and increasing the competition over the creation of a super intelligent AI. During a Ted talk event, the same author interestingly affirmed that 'we should not be confident in our ability to keep the super intelligent genie locked up in its bottle forever.

The answer here is to figure out how to create a super intelligent AI such that even if, when, it escapes it is still safe because it is fundamentally on our side because it shares our values' (Bostrom 2015).

Therefore, AI researchers are not so much concerned that a "crazy-computer" might soon gain consciousness and deliberately turn against human beings like in many dystopian movies mentioned above. Rather they are trying to understand how an advanced and efficient AI system might provoke detrimental results while performing its basic functions. A condition that resembles movies like *War Games* (1983), *Resident Evil* (2002) and *I, Robot* (2004).

Overall, the dominant perception among scientists is that all the possible existential risks associated with the further development of AI technologies should be cautiously identified and studied in advance, thus limiting undesirable and unexpected side-effects. As stated by Seth Baum (2018, n.d.), 'we need to ensure that R&D is conducted responsibly, safely, and ethically.' As a result, some researchers believe that the development of an international AI regulatory agency aimed to establish a shared legal framework for the development of AI technologies might positively contribute to achieve such goal (Erdélyi and Goldsmith 2018).

However, establishing shared rules aimed at the efficient reduction of the risks associated with advance research on AI technologies might be a complex task. Three critical issues need to be considered. First, even a precautionary strategy might not be enough to guarantee a complete management of future risks. As claimed by Eliezer Yudkowsky (2008, 248): 'it is

a risky intellectual endeavour to predict *specifically* how a benevolent AI would help humanity, or an unfriendly AI harm it.'

Second, many private companies are investing considerable resources in order to get a leading position in AI technologies. For example, according to a McKinsey Global Institute Report, in 2016 private companies invested from $26 billion to $39 billion in artificial intelligence (Bughin et al. 2017, 5). As a result, there are many people whose primary interest is to develop AI technologies as faster as possible in order to maximize the resulting profit, thus paying little attention to the safety of the process (Armstrong 2014, 44).

Third, an international AI race has just started (Gershgorn 2018). Although following diverse approaches, USA, China and Russia are already making important investments in AI research programmes (Auslin 2018). The prevailing logic among governments is that the 'first to the finish line will be the one that captures the bulk of AI's potential value' (Esposito, Tse and Entsminger 2018). In this competitive framework, it seems complicated to get the approval of global rules that might slow down states' ambitious plans. Therefore, the discussions on this theme are plausibly going to be even more at the core of the academic and political debate in the next years.

To conclude, a brief comment about the issue of consciousness in advanced AI machines. The core question is: might AI systems ever become sentient beings? Answering this question is really complicated considering, on one side, how little scientists still know about human consciousness

and, on the other side, how complex is to develop an accurate test aimed to define whether a being is sentient. At present, many IT scientist and engineers do not view it as a major problem because they do not conceive how a machine might get consciousness. At the same time, it cannot be completely excluded that an advanced AI might get consciousness of itself and its surrounding environment.

According to Stanislas Dehaene, Hakwan Lau and Sid Kouider (2017, 486), for example, 'artificial consciousness may progress by investigating the architectures that allow the human brain to generate consciousness, then transferring those insights into computer algorithms.' Still, the same authors affirm that the world is not on the verge of a similar technological revolution yet. Anyway, this issue of consciousness has multiple serious implications, ranging from the potential recognition of rights to sentient machines to the (at the moment just fictional) risk of anomalous behaviour of AI systems. Therefore, it is highly plausible that, in the coming years, a growing debate on consciousness will develop in response to the progress made in the field of robotics and artificial intelligence.

Final remarks

Artificial Intelligence is a promising technology that might revolutionize human history. Optimistically, this technology might exponentially accelerate human progress, thus turning into reality projects that have been so far unachievable. However, the development of AI technologies might also imply some substantial security risks.

For example, a widespread production and employment of offensive fully autonomous-weapons might drastically reduce the costs of war, thus raising the incentives of using force for achieving political objectives. Unless a regulatory international framework will not be soon established, the risk of a new arm race competition is concrete. Nowadays, the idea that, in a not too far future, killer-robots would get employed for warfare or anti-terrorism operations seems something more than a dystopian fantasy. Therefore, movies like *The Terminator* (1984) and *Kill Command* (2016) might have correctly anticipated some upcoming critical issues.

An inaccurate programming of AI technologies might also provoke dangerous outcomes. As shown in dystopian movies such as *Resident Evil* (2002) and *I, Robot* (2004) an advance AI might eventually harm human beings in the attempt to successfully fulfil its primary objective. Different researchers and experts of the field are working hard to make sure that such condition will never happen. Still, human capacity to keep control over advanced AI systems might reach a breaking point after which it is difficult to predict what could happen. Therefore, the main challenge is to identify a correct balance between human ambitions and security concerns being aware that a miscalculation might provoke catastrophic results.

Concerning the raise of consciousness in advanced AI systems, the world is not on the verge of a "Matrix" revolution. However, the theme seems to have a certain scientific, legal and ethical relevance. Therefore, it is highly likely that new studies on this issue will be released in the near future.

Chapter 9: Genetic Engineering

Fiction

The issue of genetic engineering is a recurrent theme in science fiction and dystopian movies. In many cases the narrated stories tend to be quite inaccurate from a scientific perspective. Nonetheless, they offer thought-provoking reflections on the benefits and risks related to genetic engineering. This chapter exclusively focuses the attention on movies dealing with acts of intentional genetic engineering, thus excluding all those stories where the genetic mutation occurs naturally like, for example, in the case of *X-Men* (2000) as well as ignoring those movies specifically centred on cloning such as *The Island* (2005). On the whole, the movies depicting intentional genetic manipulations can be divided in three broad categories according to the nature of the subject exposed to the experiments: animals, human beings or hybrid creatures.

Genetic engineering of animals

A number of movies focus the attention on the genetic engineering of animals. Interestingly, these experiments are justified by a variety of reasons and they are conducted on diverse species. In some circumstances, the objective of the experiments is to find a cure to a grave human disease. For example, in *Deep Blue Sea* (1999) and *Rise of the Planet of the Apes* (2011) scientists genetically modify sharks and monkeys in order to find a cure for Alzheimer. In both cases, the conducted tests significantly increase the cleverness of these animals, thus raising high expectations to find a cure. Unfortunately, unexpected events lead to dramatic epilogues.

In the first case, sharks attack scientists and try to destroy the whole laboratory. In the second case, the coexistence between men and apes flows into a war.

Other movies explore the idea to bring back to life lost species though genetic engineering. For example, in *Jurassic Park* (1993) scientists are able to re-create dinosaurs by extracting their DNA from mosquitoes trapped in amber, cloning it, and then combining it with the DNA of frogs. In spite of the astonishing results, the dinosaurs get out of control and start to kill their creators. Interestingly, there is one scene of the movie where a group of scientists, who have been invited by the park's owner to be the first ever visitors, raise multiple doubts over the ethical legitimacy of similar experiments. The main argument is that "playing with nature" irresponsibly might lead to unforeseen risks. In the movie, this debate acts as a prelude to the forthcoming disaster.

A third group of movies is focused on the development of genetic experiments aimed to enhance animals for military purposes. This is the case of *Jurassic World: Fallen Kingdom* (2018), where a new-genetically modified dinosaur called "Indoraptor" is specifically created with the objective to sell it in the black market as the ultimate weapon, and *Rampage* (2018), where the pathogen of an out-of-control gene manipulation experiment turns an albino gorilla, an American crocodile and a grey wolf into enormous aggressive beasts. The human capacity to keep control over these experiments seems just a mere illusion.

Genetic engineering of human beings

Several dystopian movies explore the genetic modifications of human beings. *Blade Runner* (1982) has been one of the first movies to introduce the idea of genetically engineered humanoids (known in the movie as the "replicants"). Since then, various films have explored the issue of human genetic engineering primarily following two main patterns.

On one side, there are movies which associate genetic engineering with the secretive creation of transhuman soldiers endowed with great physical strength and advanced combat skills. This is the case of films like *Universal Soldiers* (1992) and *Soldier* (1998). More recently this idea has been reiterated by the movie *Morgan* (2016) where, in the attempt to create a deadly biological weapon, a genetic-engineering company produces an enhanced human organism through the implanting of synthetic DNA. The emotional instability of the tested-subject will, however, turn the experiment into a total failure.

On the other side, there are other movies which describe a future society where human genetic engineering is a common practice. For example, in the film *Gattaca* (1997) eugenics is ordinarily applied to design babies with no physical imperfections. The abuse of this medical treatment, however, leads to a highly discriminatory society: those who are genetically modified can easily get prestigious working positions, while those who are naturally conceived are habitually employed only for the humblest jobs. The already mentioned movie *In Time* (2011) is based on different premises, but it raises similar criticisms. In this film, all people are genetically modified to age up to 25 years and then to

have just one additional year of life unless they are able to "purchase more time" by working or gambling. The result is a society where rich people can almost live forever while poor people are doomed to die at a young age.

Genetic development of hybrid organisms

Finally, there are some extravagant movies which show the possible development of hybrid organisms. For example, in *The Island of Dr. Moreau* (1996) a scientist ambitiously attempts to create through genetic modifications and DNA combinations different types of human-animal hybrids that are incapable to harm. However, the experiment turns into a total catastrophe: once freed from a pain device implanted under their skin, these beings attack their creator and kill him.

Similarly, in the movie *Splice* (2009) a group of scientists generate a strange humanoid creature (Dren) by combining different types of human and animal DNAs. At its advance development-stage Dren has, overall, a humanoid shape, but also some non-human features such as, for example, legs with backward bending knees, a tail with a regenerating stinger and a pair of retractable wings. Like in the previous case, this research gets out of control and the creature violently turns against its creators.

To sum up, genetic engineering is viewed as a conceivable, but highly risky practice in various dystopian movies. In some movies, the experiments are primarily aimed to genetically modify animals in order to find a cure against human diseases, bring to life extinct species or use them as unconventional weaponries. In other movies, the focus is on human genetic engineering. Overall, there are two main types of

experiments. First, secretive human genetic modifications primarily aimed to create unstoppable soldiers. Second, the utilization of human genetic engineering as a widespread public treatment for the improvement of various human features. Lastly, there are movies that forecast the possible development of bizarre human-hybrid creatures. Despite some initial promising results, most of these experiments provoke dangerous and undesirable outcomes, thus revealing a certain pessimism of dystopian movies towards genetic engineering.

Reality

Deoxyribonucleic acid (DNA) is a double-stranded polymeric molecule which contains the genetic information of an organism. In simple terms, genetic engineering is the manipulation of DNA structure in new combinations (LeVine 2006). Historically, human employed cultivation and breeding techniques to artificially induce genetic alterations of plants and animals. Nowadays, there are advanced techniques which allow to directly and selectively modify the genetic composition of an organism in a lab, thus significantly reducing the time required to create a live form with new genetic features.

In recent years, genetic engineering got the media attention primarily in relation to the debates over the use of genetically modified organisms (GMO) for food production. However, this section does not intend to examine the issue of food engineering – being it an aspect that has been fundamentally ignored by dystopian movies – but rather to provide an overall assessment of the state of research on the potential genetic

manipulation of animals and human beings. The objective is to show how many controversial issues raised by dystopian movies in the framework of genetic engineering are also issues of critical debate within the scientific community.

Genetic engineering of animals

An important area of research is related to the employment of genetic manipulation techniques on animals for medical aims. Simplifying, these experiments concern the addition, elimination or alteration of parts of DNA into an animal host. As explained by Manfred Wirth and Hansjörg Hauser (1993, 702), 'the choice of host cells very much depends upon the purpose of the study or on questions that need to be answered.'

On the whole, the genetic manipulation of animals is viewed as an important medical innovation in three main spheres. First, genetically manipulated animals can act as valuable models for those scientific studies aimed to investigate complex issues like, for example, the spreading of certain human diseases or the mechanisms of interaction between different genes. To date, numerous tests have already been conducted on engineered animal species for research purposes (Simmons 2008; Rogers 2016).

Second, genetically modified animals could be used as a cost-effective method for producing pharmaceutical proteins through gene farming. As stated by Louis-Marie Houdebine (2014, 7), 'about 30 proteins have now been produced in transgenic animals at the laboratory level.' However, none of these proteins is available on the market yet.

Third, genetic engineering might be used to constrain the spread of certain interspecies transmittable diseases like, for example, malaria and Zika virus (Chong, Basir, and Fei 2013; Meghani and Boëte 2018). The basic idea is to genetically intervene on the disease vector (mosquitoes) in order to eliminate their capacity to transmit infectious disease to humans.

Therefore, the idea to create genetically modified animals for medical purposes, as contemplated in *Deep Blue Sea* (1999) and *Rise of the Planet of the Apes* (2011), is already a scientifically performed practice. The fear that such experiments might, as in the above-mentioned movies, degenerate into catastrophic result is commonly viewed as an unrealistic scenario. However, there are still some serious concerns related to animal welfare and the ethical legitimacy to conduct similar experiments regardless the substantial benefits they might produce for human society (Ormandy, Dale and Griffin 2011).

Remaining in the field of animal genetic engineering, scientists have also examined the possibility to resurrect lost species through a process called de-extinction. In simple terms, this process entails a combination of diverse techniques, included selective breeding, genetic manipulation and cloning. For multiple reasons (e.g. the lack of intact DNA and the absence of biological eggs) the revival of dinosaurs seems an idea that is going to remain confined to fictional plots (Griffin and O'Connor 2018). Nevertheless, this procedure might be successful in the case of animals which got extinct in a more recent past like, for example, the woolly mammoth or the passenger pigeon.

However, even assuming that reviving extinct species would become technically feasible, should scientists do that? Palaeontologist Michael Archer (2013) suggests that persons have a moral imperative to make what it is possible to revive those species that humans rendered extinct. Actually, according to some scientists, bringing back to life certain extinct animals might produce multiple benefits for contemporary society. For example, Stewart Brand (2015) argues that the return of the woolly mammoth in the Arctic 'could provide new habitat for endangered species, help temper climate change, increase the population of elephants in the world, and bring excitement and a reframed sense of what is possible to conservation.'

Nevertheless, other researchers do not share the same enthusiasm. Some scientists view de-extinction as an unnecessary process that would just divert funds and public attention from more impending issues like the preservation of current endangered species (Kendrick 2013). Others are afraid that re-introducing extinct species into their original environment might lead to unforeseen ecological and human-health risks (Sandler 2014, 358). In addition, animal welfare organizations are seriously concerned that de-extinction might provoke a needless suffering to the revived animals (Sherkow and Greely 2013, 32).

Considering this diversity of viewpoints, openly discussing the practice of de-extinction in both the scientific and public sphere and regulating it through the development of internationally shared norms might be a valuable strategy to mitigate undesirable risks and form a constructive cooperation among the various interested groups.

A short note about the creation of genetic engineered animals for military purposes. The use of animals in warfare has a long-lasting history. For example, horses, mules and camels were used as means of transportation, pigeons for communication, elephants as war machines, dogs for rescuing and spotting duties, other species for the infamous task of transporting incendiary devices (Cooper 2000; Mayor 2014). In spite of the extensive technological development achieved in the military field, this practice has never been abandoned. As reported by Anthony J. Nocella II, Colin Salter and Judy K.C. Bentley (2014, 10), more than 2800 dogs have been actively employed by the US Army in the recent conflicts in Iraq and Afghanistan.

Movies like *Jurassic World: Fallen Kingdom* (2018) and *Rampage* (2018) suggest the idea that, in the course of the XXI century, genetically manipulated animals could be specifically created for offensive military aims. Clearly, the gap between fiction and reality is still noteworthy: it is highly unlikely that the world might see a genetically modified dinosaur or an enormous albino gorilla on the battlefield any time soon. Nevertheless, some tests have already been conducted in this framework and others are currently under scrutiny. In particular, three cases deserve to be mentioned here. First, the genetically breeding of vapor-wake dogs with an exceptional capacity to detect the scent of explosive devices (Ricks 2010). Second, the Defense Advanced Research Projects Agency's (DARPA) interest on the development of steerable insect-cyborgs for spying enemy lines (Anthes 2013). Third, the genetic manipulation of marine microorganisms to spot enemy submarines and other underwater vehicles (Tucker 2018). Plausibly, these are just the first simple, but

fundamental steps towards more advanced projects. As claimed by Benjamin Soloway (2015): 'scientists in real life are already well on their way toward genetically modifying animals for military use.'

Genetic engineering of human beings

The application of genetic engineering to human beings is another highly contentious topic. Overall, human genetic engineering can be used for diagnosis or treatment. Preimplantation genetic diagnosis, for example, is a medical technique which can be used for screening the presence of a genetically inherited diseases in an embryo. In spite of its potential utility to constrain the transmission of severe genetic disorders to the progenies, this practice is banned in some countries (e.g. Germany, Switzerland and Argentina), accepted with restrictions in others (e.g. France and UK), and still unregulated in many other states (Alexander 2003). One of the main reasons why several countries have rejected the application of this medical practice is due to its potential misuse as a tool of embryo selection for motives that are unrelated to the inheritance of serious genetic disorders (Knopper, Bordet, and Isasi 2006).

Concerning the treatments, there are two main typologies of interventions. On one side, somatic cell therapy 'adds, cuts, or changes the genes in some of the cells of an existing person, typically to alleviate a medical condition' (Center for Genetic and Society 2018b). The resulting gene manipulation affects the patient while it is not inherited by his/her offspring. On the other side, germline gene therapy concerns the manipulation of germ cells (gametes) of a male (sperm) or female (eggs) individual. The critical point is that 'these

alterations would appear in every cell of the person who developed from that gamete… and also in all subsequent generations' (Center for Genetic and Society 2018b). Theoretically, genetic engineering treatments (both somatic and germline) can be used for curative or enhancing purposes. A curative treatment is one aimed to alleviate the suffering of people affected by diseases. An enhancement treatment is one aimed to improve certain specific characteristics of an individual for reasons unrelated to his/her healthcare.

Even if the experimentation of somatic cell therapies seems just at the beginning, 38 countries have already undertaken almost 2,600 clinical trials up to November 2017 (Ginn, Amaya, Alexander et al. 2018). Providing a comprehensive assessment of these therapies is beyond the scope of this book because different types of treatments have been tested in relation to diverse kinds of diseases (e.g. monogenic hereditary diseases, certain viral infections, and pathogenic microorganisms). Overall, there are noteworthy differences in the results attained so far: some therapies produced promising results, while others clashed against serious challenges (Misra 2013). This variability of results has raised some doubts over the medical efficacy of these therapies and their safety. One of the main difficulties is that the vectors currently used for delivering the altered genes to the target cells are safe, but little efficient (plasmids) or highly efficient, but more risky (viral vectors) (Linden 2010, 42). However, as claimed by Fulvio Mavilio and Giuliana Ferrari (2008, S64 and S66), 'it is unrealistic–and unfair–to expect from genetic medicine what no other medical intervention has ever provided: a perfect and safe cure without any side effects… knowing the risks of a therapeutic approach–and

understanding the causes of its failures or side effects–is the only to improve the technology.' Overall, there is a growing international consensus over the use of genetic therapies in somatic cells for purpose of treating severe disorders (Gonçalves and Paiva 2017).

As in dystopian movies, the possible use of somatic cell treatments for improving certain human physical traits has gained the attention of the military industry. In recent years, the potential creation of a new generation of "super-soldiers" has been reiterated by various newspapers and websites. In 2017, Russian President Vladimir Putin warned the world that the potential rise of genetically engineered soldiers might be "worse than a nuclear bomb" (Best 2017). Arguably, the constant progress made in the field of genetic engineering might, one day, allow to increase soldiers' strength, endurance and pain tolerance. However, current scientific knowledge and available techniques do not allow to achieve such results yet (Farley 2016). Therefore, the organization of an army of genetically engineered super-soldiers seems, at present, still confined to the realm of fiction. Differently, the studies conducted by DARPA seem to suggest that wearable exoskeletons and brain implants might be employed by militaries in the next future. However, these are topics that go beyond the scope of this chapter.

Undoubtedly, germline gene therapy is the most contested issue in the framework of human genetic engineering. At the core of the debate, there is an ethical dilemma between scientific knowledge and moral responsibility as well as an ontological dilemma between determinism and human freedom (Peters 2003). The movie *Gattaca* (1997) provides a

good visual representation of these dilemmas, raising deep questions like: do genes determine who we are and what can we do? Should humans embrace or reject the possibility to manipulate their genes and the genes of their children? At what risk? Many people are seriously concerned that any experimentation of germline gene therapies might open a Pandora's box.

At present, it is technically impossible to conduct genetic enhancements aimed to design babies as in the above-mentioned movie (Belluck 2017). Improving physical traits like intelligence, temperament and memory would require the manipulation of a large number of genes with a high risk of undesirable off-target outcomes. However, recent medical studies revealed that the manipulation of a specific gene in a human embryo is an achievable practice. In 2017, for example, a group of researchers successfully corrected a mutation of the MYBPC3 gene which is responsible of hypertrophic cardiomyopathy (Ma, Marti-Gutierrez, and Park et al. 2017). Moreover, the knowledge and understanding of human genome is progressively growing thanks to scientific research. As a result, the capacity to intervene through gene editing on a growing number of human physical traits might increase in the next future. Nevertheless, the enhancement of certain complex features could possibly remain beyond human capabilities (Belluck 2017).

The public attention on germline gene therapy has risen steeply when Chinese scientist Jiankui He claimed to have edited CCR5 genes in human embryos coming from couples where the fathers were HIV positive. The objective was to favour the birth of new-born babies who would not be

vulnerable to HIV infection. This process led to the birth of the first genetically edited babies in November 2018 (Belluck 2018). This clinical trial has been severely criticized by the international scientific community. One of the main criticisms is that this procedure modified normal embryos and exposed them to unnecessary risks, thus violating the most fundamental ethical principles of medicine. As a result, the Executive Director of the Center for Genetics and Society, Marcy Darnovsky, claimed that this trial "amounts to unethical and reckless experimentation on human beings, and a grave abuse of human rights" (Darnovsky quoted by Center for Genetics and Society 2018a). Likewise, 149 Chinese HIV researchers signed a letter in which they firmly condemn the editing of healthy embryos for reproductive purposes and HIV prevention (Zhang, Zhong, and Zhai et al. 2018). The same Chinese authorities have labelled the work of Jiankui He as unethical and illegal (Kuo 2018). In response to this controversial case, UNESCO (2018) has publicly remarked 'the absolute need to heed internationally agreed principles that affirm the value of human rights and human dignity as the prime concern for any medical research and intervention on human beings.'

Beyond this specific case, there are six main objections to the application of germline gene therapy on human embryos (yougergenome.org 2015; Skerrett 2015; National Academies of Sciences 2017, 121-130). First, this method has still to be optimized from a technical perspective. At present, the effects of germline gene therapies are too unpredictable to be safely tested on human beings. Moreover, considering that the genetic alterations introduced with this method will be

inherited by the successive generations, a particularly cautious approach is required.

Second, for several diseases there are less risky alternative therapies to apply. Therefore, there is no need to proceed with a risky therapy while accurate and safe medical procedures are already available. Germline gene therapy should be eventually considered as a last resort. Third, the individual rights of unborn babies are at stake. In other terms, do really the parents of a baby have the rights to manipulate his/her genes without his/her consent? Who is going to be legally responsible for eventual unforeseen damages that would preclude to these babies the right to a healthy life?

Fourth, the use of germline gene therapies is ethically questionable. Some genetic disorders (like those causing, for example, dwarfism or deafness) are viewed by some people as diseases while, by others, they are interpreted as alternative ways of life. Would be ethically acceptable to intervene and "correct" these disorders? In addition, germline gene therapies could be used in the future for the enhancement of certain physical features, thus contributing to shape an ideal model of human being. This eventual form of eugenics is viewed by many as immoral and risky for the preservation of human diversity. Fifth, religious groups and believers are concerned that germline gene therapies for enhancement purposes might undermine the value of human life. Genes are fundamental components that determine the physical and behavioural predisposition of an individual. Their artificial manipulation might directly affect the essential nature of being human as well as promote the misleading idea of viewing babies as a product to be designed in labs.

Sixth, many scientists are seriously concerned about the socio-economic consequences of germline genetic therapies. At first, this method will be plausibly highly expensive and, therefore, available only for the wealthiest families. Moreover, it is quite conceivable that the creation of enhanced babies will cause social discrimination for those who did not received enhancement treatments. As a result, the socio-economic gap will further exacerbate and reach unprecedented heights.

Taking into account these controversial aspects, the American Society of Human Genetics (ASHG) workgroup called for a temporary restriction to the therapeutic development of germline clinical trials ending in human pregnancy, while they supported the scientific research of in vitro germline gene editing (Ormond, Mortlock, and Scholes et al. 2017).

Nevertheless, there are also authors who are firmly in favour of germline gene therapies. For example, according to Ted Peters (2003, xvii), 'despite DNA determinism, we as person are still free. We are also morally responsible. That responsibility includes building a better future through genetic science.' In the view of Peters, there is nothing sacred in genes and, therefore, eventual improvements of human life conditions through genetic engineering should be enthusiastically welcomed. Moreover, the current lack of knowledge over the long-term consequences of genetic engineering should not be taken as an excuse to block the research in this field. Instead, this uncertainty should be viewed as a sign warning us to proceed cautiously, but keeping also in mind that nature is dynamic and we, as

humans, cannot stand still (Peters 2003, 214). This view is also supported by Henry I. Miller (2016), who stated: 'interventions that involve germline gene therapy should be used sparingly and with scrutiny, but if we don't take the first step of clinical application, the one certainty is that we'll never reach the goal of applying gene editing to the reduction of human suffering.'

Overall, there are reasonable arguments both in defence and against the application of human genetic manipulation. A core challenge is to equally balance 'individual-level benefits and social-level risks' (National Academies of Sciences 2017, 119). The fact is that a grey area marks the border between, on one side, an ethically legitimate use of this advanced methodology and, on the other, an unethical and risky abuse of this practice. The ideal solution would be to maximize the benefits and limit the risks and undesirable consequences. How to gain there without fostering a dystopian society, like *Gattaca* (1997) or *In Time* (2011), is still problematic.

Genetic development of hybrid organisms

Although the development of hybrid creatures might seem a highly fictional perspective, scientists are actually exploring the possibility to create animal-human hybrids for xenotransplantation (the transfer of organs from one specie to another). This area of research has raised the highest expectations, but also the most severe criticisms.

In 2017, scientists created the first human-pig chimeras (Begley 2017). Basically, the researchers injected human stem cells in pig embryos in order to study the potential development of organs containing human cells in the bodies of large animals. For ethical reasons, the experiment was interrupted before the embryos passed the foetal stage.

Overall, the rate of surviving human-pig embryos was quite low and the human cells identified in the enduring embryos were relatively few (about 1 in 100,000 cells). Nevertheless, this research introduces a ground-breaking prospect: the development of human-animal hybrids for research activities, testing of drugs and organs transplantation might become practicable in the future.

One year later, another group of scientists conducted a similar experiment by creating the first human-sheep hybrids (Yirka 2018). As in the former case, the results of this experiment suggest that, despite the technical difficulties encountered by the scientists, the undertaken path could lead to a positive outcome. Plausibly, further research in this field will be conducted in the next years. In case of success, this discovery could represent an exceptional turning point for the medical science in view of the approximately 56,000 people in Europe and 121,000 people in the USA who are in the organ transplant waiting list (European Commission 2014; National Kidney Foundation 2017).

Still, many people reluctantly reacted to this pioneering idea. First, several groups fighting for the defence of animal rights have labelled the creation of human-animal hybrids as an unnecessary and barbaric practice. Their main concern is that these experiments would just lead to an unjustified increase of the number of animals suffering in laboratories without really offering valuable solutions to those people who need organs transplantation (Bailey 2016). Therefore, according to Anne Clark (2016): ‘with more investment and use of humane cutting-edge technology, we’ll have much better science than

the monstrous “frankenscience” of creating human-animal hybrids.’

Second, some scientists expressed a certain perplexity about the medical results that can be achieved through this innovative method (Moy 2017). Complex technical obstacles, such as the immunological rejection of the transplanted organs in the receivers and the risk that animal pathogens might widespread to the human body, severely constrain the successfully and safely transplantation of organs from one specie to another (Mohiuddin 2007; Boneva and Folks 2004). Therefore, a cautious approach should be maintained before considering human-animal hybrids as valid solutions to deal with the shortage of human organs available for transplants.

Third, some people believe that mixing human and animal DNAs is a highly immoral practice that should be completely banned. This extreme position is dictated by the fear of creating aberrant creatures by transferring a human-like consciousness in animal brains, shaping chimeras with human-like external features, or producing animals with human gametes (Bourret, Martinez, Vialla et al. 2016, 87). If scientists want to constrain the reluctancy towards this controversial scientific method they will probably have to publicly explain how they are going to maintain their experiments within acceptable ethical standards as well as how the creation of human organs in hybrid creatures will provide outstanding benefits for everyone.

Final remarks

Scientifically, genetic engineering is an outstanding, but delicate turning point for humanity. Considering the spectre of its potential applications, genetic engineering could reconceptualize 'our knowledge of what life is and what it means to be human, and where humans sit in the order of nature' (Small 2012, 227). However, many people have also expressed serious concerns with the ethical questions and long-term implications associated with the use of genetic manipulation on animal and human cells (Frewer, Howard, and Shepherd 1997, 117). The result is a clash of views where 'the defenders of genetic research seek to justify its ultimate power to do good, while the critics seek to demonstrate how this approach crosses lines that the human species should not dare to traverse' (Francis S. Collins foreword in Peters 2003, ix).

Certainly, genetic engineering raises a number of complex ethical and practical questions that require great attention. In this regard, dystopian movies warn about the potentially catastrophic side-effects of both uncontrolled and systemic genetic manipulations. However, the critical point is not really genetically engineering by itself, but rather how and for what this advanced scientific technique will be used in the next years. Considering the potential benefits that this technique might offer to humanity (providing, for instance, medical therapies aimed to relieve people's suffering due to genetic predispositions towards severe diseases like cystic fibrosis or Duchenne Muscular Dystrophy) it might worth to thoughtfully proceed with the scientific research in this field.

Still, increasing the public consensus over this practice seems an essential requisite for success. This result could be partially achieved by cohesively working on two key factors. First, formulating an internationally shared code of professional standards (possibly, within the framework of the WHO) for the research and clinical use of genetic engineering. Conceivably, the seven general principles for research on and clinical application of human gene editing – promoting well-being, transparency, due care, responsible science, respect for persons, fairness, and transnational cooperation – drafted by the National Academies of Sciences (2017, 33) could be taken as basic pillars for the development of more precise rules. Second, fostering the public awareness over genetic engineering and constructively engaging the civil society in the development of ethical guidelines (Verma 2001). In this regard, 'it will be of paramount importance to continue to inform the public objectively, to discuss issues in detail, and to provide intelligible information in order to prevent extremists and fanatic activists from gaining acceptance caused by wrong assumptions' (Brem 1993, 814).

Concluding, one key question remains unsolved: should human genetic engineering be applied to the exclusive cure and prevention of harmful diseases or should also its application be extended to some forms of enhancement-oriented treatments? For some authors 'there are neither medical nor moral reasons for this type of intervention' (Glannon 2001, 80). For others, enhancing the human species might be an ideal condition in order to achieve in the future new ambitious goals such as, for example, the colonization of space (Rosen 2014). Still, history shows that once an innovative medical practice become feasible (e.g. surgical

interventions) it also becomes, in a few years, suitable and saleable for non-medical purposes (e.g. plastic surgery). Therefore, in the event that genetic engineering should one day become a concrete option, binding it to selected medical interventions could be ethically desirable, but practically unfeasible.

Conclusions

'It is change, continuing change, inevitable change that is the dominant factor in society today. No sensible decision can be made any longer without taking into account not only the world as it is, but the world as it will be – and naturally this means that there must be an accurate perception of the world as it will be. This, in turn, means that our statesmen, our businessmen, our everymen must take on a science fictional way of thinking, whether he likes it or not, or even whether he knows it or not. Only so can the deadly problems of today be solved.'

Asimov, I. (1978), Foreword.
In Holdstock, R. *Encyclopedia of Science Fiction*

One of the fundamental features of dystopian stories is to use a "what might happen if…" construction in order to show how terrible might be the future if we do not solve the most serious problems afflicting our current society. The final result is the construction of an imaginary world, which is nonetheless the product of both creativity and analytics. Chapter by chapter, this book has identified some of the most recurrent features of modern dystopian films – in relation to climate change, lack of vital resources, overpopulation, global pandemics, social inequality, authoritarianism, weapons of mass destruction, artificial intelligence and genetic engineering – and it has compared them with actual data. The core conclusion is that, in several respects, the world is dangerously close to some dystopian scenarios.

Dystopian movies suggest that the world might face a drastic transformation in the next future as effect of climate change. The three most commonly prospected scenarios are: a never-ending wasteland, a world completely submerged by water, and the rise of a new ice-age. What the available scientific data tell us is that climate change is altering the natural equilibriums, thus putting at risk the ecosystems of the Earth. The combined effect of CO2 emissions and global warming are already producing a series of chained transformations that might inevitably force millions of people to choose between abandoning their homes or living in highly hostile environments.

The lack of vital resources and the resulting struggles for their control is another familiar theme of contemporary dystopian movies. Despite the positive results achieved so far, almost 800 million people in the world do not have regular access to food and clean water. The problem of hunger seems primarily related to inconvenient, but reversable socio-political conditions like, for example, the unequal distribution of resources, poverty, or a state of war. Differently, the issue of water scarcity is more complicated, being related to multiple factors such as a physical lack of water, inadequate investments for the required infrastructures and technologies, and a mismanagement of the available water resources. The problem is that around 40% of people in the world are affected by water scarcity and this condition might worsen already existing tensions between some neighbouring countries.

A number of dystopian movies describe the consequence of a drastic demographic growth and they explore the resulting

extreme policies that might be adopted by the concerned governments to face the problem. The forthcoming demographic growth, which will plausibly increase world population to something between 9.6 and 13.2 billion people by 2100, is destined to further fuel the overpopulation debate and the issue over the distribution of resources. In some developing countries, introducing restrictions to the freedom to breed could be viewed as a worthy option. However, the case of the People's Republic of China shows that such policy might generate some controversial side-effects such as an increase in the number of unregistered people, an increment of illegal abortions, and a disbalance of genders.

Another recurring topic of dystopian movies is the spread of global pandemics that would provoke massive casualties. Like in fictional movies, infectious diseases are a serious concern for contemporary society despite the outstanding results achieved in the biomedical science. Every year diseases like, for example, HIV/AIDS and Tuberculosis cause more than a million deaths in the world. A disease like Malaria can spread to over 200 million people in the same period of time. The increasing levels of connectivity, human mobility and urbanization might also favour the spread of contagious diseases on a global scale, thus turning the risk of a new global pandemic in something more than a mere fictional speculation.

Different dystopian movies are set in extremely unequal societies, where few rich people live in luxury, while all the others struggle for survival. With 1% of people in the world controlling as much wealth as the remaining 99%, the contemporary socio-economic gap has already reached levels

that bring to mind such dystopian stories. In addition, over 700 million people in the world live in a condition of extreme poverty (less than $1.90 a day) and 2.7 billion people live with less than $2.50 a day. In prospect, the social inequality issue is going to remain a central problem considering that 2 billion people will probably live in a slum by 2030, 400 million people in the world still do not have access to essential health services, and considering that the most disadvantaged groups are apparently those who mainly suffer from violent crimes.

From a political perspective, dystopian worlds are characterized by the affirmation of authoritarian regimes guided by charismatic and merciless leaders. In the last decades, the world has assisted to a return of authoritarian regimes and the rise of hybrid governments. Among the restrictive policies commonly adopted by these governments there are some that remind those shown in dystopian movies. They include, *inter alia*, the imposition of a system of media control, propaganda and disinformation to counter the citizens' dissatisfaction as well as the arrest or exile of political dissidents to preventively stop any attempt of uprising. Whether this authoritarian wind should be viewed as a temporary fluctuation or a long-lasting process is currently under debate.

Several dystopian movies warn about the tremendous power and wide-ranging destructive effects of nuclear, chemical and bacteriological weapons. Different past events show how escalating tensions, political miscalculations and technical errors pushed several times the world on the verge of a nuclear war. Similar circumstances might take place again in the upcoming future, but with a more catastrophic outcome.

Likewise, bacteriological weapons remain a serious threat. Even if their use has been significantly limited since the enforcement of the 1972 Biological Weapons Convention, any offensive use of these weapons could lead to unpredictable consequences. Chemical weapons have a more constrained destructive impact compared to nuclear and biological weapons. Their reiterated use in the last years is, however, raising some doubts over the efficacy of the existing international legal ban.

Numerous dystopian movies have also explored the risks associated with an uncontrolled artificial intelligence. The most alarming scenarios refer to killer-robots and the rise of out-of-control AI systems. The constant progresses made in the field of autonomous weapons and artificial intelligence are, actually, raising a series of ethical, legal and technical concerns over the impact that these technologies might have on human society. At present, the idea that an artificial intelligence technology might turn against human beings is still confined to the realm of science fiction. However, like in dystopian movies, a central – still unsolved – question is how to keep control over these powerful technologies so that they will not cause undesired harm on human beings.

Dystopian movies also offer a negative representation of genetic engineering. Overall, these stories warn humanity about the risks associated with uncontrolled experiments of genetic manipulation and undesirable societal changes due to human genetic enhancement. Technically speaking, most of the experimentations shown in dystopian movies are unfeasible at the current state of research. However, important results have already been achieved in this field,

included: the creation in the lab of the first human-animal hybrid embryos, the development of scientific studies about the revival of different extinct species, the application of somatic cell therapies to cure genetic diseases, and the birth of genetically manipulated babies. As a result, all those critical questions raised by dystopian movies (e.g. the ethical aspects related to the manipulation of genes, the risks of detrimental effects for the human health and the natural environment, and the social long-term consequences of human genetic engineering) are nowadays themes of heated debates within the scientific community.

Acknowledging the shocking, but valuable truth that some dystopian movies might be closer to current reality than commonly expected should not be viewed as a condition for anxiety and despair. Rather, awareness of the complexity of contemporary global challenges is a prerequisite for the identification of preventive and responsive strategies. As claimed by Robert Wuthnow (2010, 215) 'when serious threats [suddenly] occur, people react with fear and disbelief… When the initial shock subsides or when a threat is only anticipated or distant, a different reaction is more common. This reaction consists of sense-making activities, such as absorbing and sharing information and engaging in preventive or ameliorative behaviour.'

Climate change is a serious and complex challenge for contemporary society that cannot be ignored anymore. The risk that the world has already reached and passed the point of no return is high. Nevertheless, 'we can create a safer and more resilient future if we work together to rethink the way we produce and consume energy, food, and water; protect

the world's forests; and help people prepare for inevitable change' (WWF, 2018).

Food and water scarcity are a threat for millions of people in the world. Possibly, global warming and demographic growth will make the resolution of these problems even more complex in the near future. Nevertheless, 'we have made significant breakthroughs over time to manage our scarce resources […Therefore,] we should be realistic about the challenges ahead but optimistic about our future, realizing that we must work hard towards realizing that optimistic future' (Runde 2017, n.d.).

Government-imposed single or two-child policies are often viewed as the sole conditions to prevent overpopulation. However, there are some valid alternatives to consider. Empowering women's status through education and business opportunities and providing family-planning services are practices that might gradually limit the demographic growth and 'enabling women and couples to achieve their desired family size' (UN 2017, 6).

Transmittable diseases are one of the main causes of death in the world and a serious risk for the future. However, the outstanding progresses achieved in the medical sciences have allowed to prevent and promptly counter many epidemic outbreaks. Therefore, as stated by the World Health Organization (2015, 10): 'we have [now] the benefit of hindsight and an unprecedented opportunity to revamp our collective approach to preventing and controlling epidemics so that we can mitigate their impact.'

The income gap between the richest and poorest people in the world has already reached unbelievable levels and it is further widening. Anyway, it is possible to tackle such extremely unequal condition through a more human economy: 'together we need to create a new common sense, and turn things on their head to design an economy whose primary purpose is to benefit the 99%, not the 1%' (Oxfam 2017, 6).

Nowadays, liberal democratic principles are dangerously challenged by new autocratic governments which use devious techniques to control their citizens. Nevertheless, this condition does not necessarily set forth the rise of a new political era: 'liberal states should not assume that history has ended, but they can still be certain that it is on their side' (Deudney and Ikenberry 2009, 93).

The mere existence of weapons of mass destruction is, by itself, a serious threat to world peace and stability. Still, the international system has already approved and enforced a series of legal tools aimed to prevent the construction of new nuclear, chemical and bacteriological weapons as well as progressively reduce the already existing stockpiles. Political willingness is the key condition for continuing along this path. As claimed by the former United Nations Secretary General – Ban Ki-moon (2013): 'a world free of all weapons of mass destruction will require the committed efforts of us all.'

Artificial Intelligence systems are a potential turning point of human history: they can help humans to reach new levels of development, but they can also hide dangerous risks. In this uncertain framework, 'the conscientious development of AI

systems that carefully considers the coevolution of humans and technology in hybrid thinking systems will help ensure that humans remain ultimately in control, individually or collectively, as systems achieve superhuman capabilities' (WEF 2018).

Finally, genetic engineering is a discovery that raises many doubts and fears. However, genetic engineering might also offer effective solutions to complex issue like organs transplant and the treatment of severe genetic diseases. Therefore, according to Nobel Prize winner Sir Venki Ramakrishnan, "what we need is a diverse and transparent group of people to really come together and get to grips with how do we go about using this tool and are there red lines… we shouldn't cross" (Ramakrishnan quoted in Sample 2016).

Therefore, carelessness and procrastination might push humanity on the verge of the darkness. But the world is not inevitably doomed to be a dystopia. In the course of history, human beings showed an outstanding capacity to solve complex challenges through progress and innovation. So, there is still a glimmer of optimism for a more welcoming future. However, contemporary global society need to understand the complexity of these challenges and take the required actions to face them. This might be the only way to avoid that the world might turn into one of those terrible scenarios shown in dystopian movies. As stated by Stephen Hawking: 'We are all time travellers, journeying together into the future. But let us work together to make that future a place we want to visit' (Hawking 2018, 20).

Filmography

Chapter 1

2012 (2009), Directed by Emmerich R., USA.

4:44 Last Day on Earth (2011), Ferrara A., USA.

Automata (2014), Directed by Ibáñez G., Spain-Bulgaria.

Dredd (2012), Directed by Travis P., USA-UK-South Africa.

Geostorm (2017), Directed by Devlin D., USA.

Judge Dredd (1995), Directed by Cannon C., USA.

Mad Max: Fury Road (2015), Directed by Miller G., Australia-USA.

Maze Runner: The Scorch Trials (2015), Directed by Ball W., USA.

Snowpiercer (2013), Directed by Joon-ho B., South Korea.

The Colony (2013), Directed by Renfroe J., Canada.

The Day After Tomorrow (2004), Directed by Emmerich R., USA.

The Road (2009), Directed by Hillcoat J., USA.

Wall-E (2008), Directed by Stanton A., USA.

Waterworld (1995), Directed by Reynolds K., USA.

Chapter 2

Doomsday (2008), Directed by Marshall N., UK-USA-Germany.

Hell (2016), Directed by Fehlbaum T., Germany.

Interstellar (2014), Directed by Nolan C., USA-UK.

Mad Max: Fury Road (2015), Directed by Miller G., Australia-USA.

Snowpiercer (2013), Directed by Joon-ho B., South Korea.

Tank Girl (1995), Directed by Talalay R., USA.

The Book of Eli (2010), Directed by Hughes brothers, USA.

The Hunger Games (2012), Directed by Ross G., USA.

The Last Survivors (2014), Directed by Hammock T., USA.

The Matrix (1999), Directed by The Wachowski Brothers, USA-Australia.

The Road (2009), Directed by Hillcoat J., USA.

The Survivalist (2015), Fingleton S., UK.

This Is the End (2013), Rogen S. and Goldberg E., USA.

Turbo Kid (2015), Directed by Simard F., Whissel A., and Whissel, Y. K., Canada-New Zealand.

What Happened to Monday (2017), Directed by Wirkola, T., UK-France-Belgium.

Young Ones (2014), Directed by Paltrow J., USA.

Chapter 3

A.I. Artificial Intelligence (2001), Directed by Spielberg, S., USA.

Aeon Flux (2005), Directed by Kusama, K., USA.

Avengers: Infinity War (2018), Directed by Russo, A. & Russo, J., USA.

Children of Men (2006), Directed by Cuarón, A., UK-USA.

Elysium (2013), Directed by Blomkamp N., USA.

Fortress (1992), Directed by Gordon, S., Australia.

Idiocracy (2006), Directed by Judge, M., USA.

In Time (2011), Directed by Niccol, A., USA.
Inferno (2016), Directed by Howard, R., USA.

Interstellar (2014), Directed by Nolan C., USA-UK.

Pandorum (2009), Directed by Alvart, C., Germany-UK-USA.

The Handmaid's Tale (1990), Directed by Schlöndorff, V., USA.

The Purge: Anarchy (2014), Directed by DeMonaco, J., USA.

Red Planet (2000), Directed by Hoffman, A., USA-Australia.

What Happened to Monday (2017), Directed by Wirkola, T., UK-France-Belgium.

Chapter 4

12 Monkeys (1995), Directed by Gilliam T., USA.

28 Days Later (2002), Directed by Boyle D., UK.

28 Weeks Later (2007), Directed by Fresnadillo, J.C., UK-Spain.

Absolon (2003), Directed by Barto D., Canada-UK.

Carriers (2009), Directed by Pastor A. and Pastor D., USA.

Contagion (2011), Directed by Soderbergh S., USA.

Dawn of the Planet of the Apes (2014), Directed by Reeves M., USA.

The Flu (2013), Directed by Sung-su K., South Korea.

I Am Legend (2007), Directed by Lawrence F., USA.

Outbreak (1995), Directed by Petersen W., USA.

Resident Evil (2002), Directed by Anderson P.W.S., Germany-UK-Canada-France-USA.

World War Z (2013), Directed by Foster M., USA.

Chapter 5

Code 46 (2003), Directed by Winterbottom M., UK.

Elysium (2013), Directed by Blomkamp N., USA.

In Time (2011), Directed by Niccol, A., USA.

Land of the Dead (2005), Directed by Romero G.A., Canada-USA-France.

Metropolis (1972), Directed by Lang F., Germany.

Ready Player One (2018), Directed by Spielberg, S., USA.

Repo Men (2010), Directed by Sapochnik M., USA-Canada.
Self/less (2015), Directed by Singh, T., USA.

Snowpiercer (2013), Directed by Joon-ho B., South Korea.

The Hunger Games (2012), Directed by Ross G., USA.

The Hunger Games: Catching Fire (2013), Directed by Lawrence F., USA.

The Hunger Games: Mockingjay – Part 1 (2014), Directed by Lawrence F., USA.

The Hunger Games: Mockingjay – Part 2 (2014), Directed by Lawrence F., USA.

The Purge (2013), Directed by DeMonaco, J., USA.

Chapter 6

Equilibrium (2002), Directed by Wimmer, K., USA.

Land of the Blind (2006), Directed by Edwards, R., UK-USA.

Nineteen Eighty-Four (1984), Directed by Radford, M., USA.

The Hunger Games (2012), Directed by Ross G., USA.

The Hunger Games: Catching Fire (2013), Directed by Lawrence F., USA.

The Hunger Games: Mockingjay – Part 1 (2014), Directed by Lawrence F., USA.

The Hunger Games: Mockingjay – Part 2 (2014), Directed by Lawrence F., USA.

V for Vendetta (2006), Directed by McTeigue, J., USA-Germany.

Chapter 7

12 Monkeys (1995), Directed by Gilliam T., USA.

9 (2009), Directed by Acker S., USA.

Air (2015), Directed by Cantamessa C., USA.

Batman Begins (2005), Directed by Nolan C., UK-USA.

Blackhat (2015), Directed by Mann, M., USA.

Deterrence (1999), Directed by Lurie R., USA-France.

Dr. Strangelove or: How I Learned to Stop Worrying and Love the Bomb (1964), Directed by Kubrick S., UK-USA.

Fail-Safe (1964), Directed by Lumet S., USA.

Resident Evil (2002), Directed by Anderson P.W.S., Germany-UK-Canada-France-USA.

Terminator 2: Judgment Day (1991), Directed by Cameron J., USA.

Terminator 3: Rise of the Machines (2003), Directed by Mostow J., USA.

The Crazies (2010), Directed by Eisner B., USA.

The Divide (2012), Directed by Gens X., UK.

The Sum of All Fears (2002), Directed by Robinson P.A., USA.

Total Recall (2012), Directed by Wiseman L., USA.

V for Vendetta (2006), Directed by McTeigue, J., USA-Germany.

Chapter 8

2001: A Space Odissey (1968), Directed by Kubrick S., UK.

9 (2009), Directed by Acker S., USA.

Hardware (1990), Directed by Stanley R., UK.

I, Robot (2004), Directed by Proyas A., USA.

Judge Dredd (1995), Directed by Cannon D., USA.

Kill Command (2016), Directed by Gomez S., UK.

Resident Evil (2002), Directed by Anderson P.W.S., Germany-UK-Canada-France-USA.

Screamers (1995), Directed by Duguay C., Canada-USA.

The Terminator (1984), Directed by Cameron J., USA.

Terminator 3: Rise of the Machines (2003), Directed by Mostow J., USA.

The Matrix (1999), Directed by the Wachowski Brothers, USA-Australia.

Wall-E (2008), Directed by Stanton A., USA.

War Games (1983), Directed by Badham J., USA.

X-Men: Days of a Future Past (2014), Directed by Singer B., UK-USA.

Chapter 9

Blade Runner (1982), Directed by Scott R., USA-Hong Kong.

Deep Blue Sea (1999), Directed by Harlin R., USA.

Gattaca (1997), Directed by Niccol A., USA.

In Time (2011), Directed by Niccol, A., USA.

Jurassic Park (1993), Directed by Spielberg S., USA.

Jurassic World: Fallen Kingdom (2018), Directed by Bayona J.A., USA.

Morgan (2016), Directed by Scott L., UK-USA.

Rampage (2018), Directed by Peyton B., USA.

Rise of the Plante of the Apes (2011), Directed by Wyatt R., USA.

Soldier (1998), Directed by Anderson P.W.S., USA.

Splice (2009), Directed by Natali V., Canada-France.

The Island (2005), Directed by Bay M., USA.

The Island of Dr. Moreau (1996), Directed by Frankenheimer J., USA.

Universal Soldiers (1992), Directed by Emmerich R., USA.

X-Men (2000), Directed by Singer B., USA.

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